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ABSTRACT

This issue features three articles which represent social and ethical concerns effecting all world citizens. The first article explores various aspects of world problems that exemplify a recurrent pattern in disputes surrounding the introduction of technological innovations and developments in Western society. The second article focuses on a specific case study in the social confrontation of science, technology, and values. The third article cites results of an American Association for the Advancement of Science (AAAS) survey in which members of scientific societies were asked questions to determine the extent of scientific societies' activities related to issues of scientific freedom and responsibility, the characteristics of societies associated with such activities, and the societies' responses to a 1975 AAAS committee report on scientific freedom and responsibility. Many news items are presented. A literature review section and meeting report are also included. An extensive bibliography and a calendar listing coming events through September 1980 are presented. (CS)

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Editorial

It is widely thought that the state of public understanding of science in the United States, and indeed throughout much of the industrialized world, is in need of fundamental re-examination.

These words ring just as true today as in October 1972 when they introduced our first issue. In the intervening years, *Science, Technology, & Human Values* has spurred that re-examination of both public understanding and response to science and technology. Now, with Issue # 29, the journal enters a new state in its life and that process.

This September, the new M.I.T. Program in Science, Technology and Society joined Harvard's John F. Kennedy School of Government as Co-sponsor of the journal. These sponsors represent a natural intellectual blend of the editorial mandate of *Science, Technology, & Human Values*. For not only is the journal concerned with science and technology in their social context, and in the associated study of them as organizations, but it also regularly examines the public policy implications and the international reverberations of these institutions, whose slightest shrugs can vibrate or shatter.

In our first incarnation, as the

Newsletter of the Harvard Program on Public Conceptions of Science, we looked "to improve communication among those researchers in various disciplines who are now studying the state of public understanding of science, or who might be intrigued into joining such studies." The newsletter was a "clearinghouse, a link between people who should be in touch with one another," which actively encouraged readers to share information about courses, programs, meetings, and work in progress. The response was heartening. As the "Harvard Newsletter" (as many still call us) developed, the field changed too. We gained from each other.

Those early issues contained many brief announcements of programs and projects that now regularly grace our intellectual banquet. The seminars that later resulted in the 1974 *Daedalus* issue on "Science and the Public" (Issue # 1), formation of the Commission on Science Policies (# 2), announcement of a new Science Programming Group at WGBH-Boston to develop the "NOVA" series (# 3), establishment of the AAAS and APS Congressional Fellows Program (# 4), publication of *Science Indicators* 1972 (# 5), and formation of the

Society for the Social Studies of Science (# 15)—these are just some of the announcements that testified to an encouraging growth of academic and governmental concern about the social and ethical implications of interaction of the scientific and technical sphere with human society.

The fact that *STHV's* first editorial sentence is as true today as seven years ago, however, serves as a reminder that the work is perhaps still in its first stages. In the face of world socio-economic problems that often involve science and technology at every turn, the questions seem, if anything, even more serious and more in need of answers sensitive to human values. How can genuine concern about the future impacts of science and technology on the human community—and scholarly interest in the subject—be turned into solutions for shifting energy sources? or toward resolution of such agonizing dilemmas as parallel debates over population control, fetal research, and mechanical prolongation of life, often all in the same country? The ethics and values considerations in weather modification or natural disaster prediction; all the whats, whys, and wheres of nuclear

power generation; arms control and monitoring hostile borders; increasing the efficiency of credit systems while protecting individual privacy—these are serious issues of the day, not idle exercises for academic roundtables.

At the June 1979 AAAS R&D Colloquium, Rep. George E. Brown [D-California] noted that Congress still regards science with the glow of mysticism resulting from the developments of World War II, but he believes that this attitude will not continue indefinitely. Members of Congress are beginning to ask for some proof of return on the national investment in basic research: "We're going to expect science...to come up with an answer to the energy crisis," Brown stated. He then admonished the scientific community to recognize that "the health of science is closely interrelated with the health of the nation," and that appropriate action would include discussion of national goals for science and

"strategic policy planning" by the scientists and engineers.

Popular attitudes to science—and the attitudes of Congressmen—have for years successfully reconciled the image of the tinkering, eccentric, unfathomable, scientific genius with the reality of scientific and technological accomplishments. It may be less easy for them to reconcile the need for innovative solutions to society's problems with untrammelled scientific freedom. Clearly, legislators, government officials, and the public are beginning to insist that the scientific community help to solve particularly those problems exacerbated by scientific and technological advances. Few will be resolved only through technical solutions. Most also involve complicated sociological, ethical, political, or other "non-scientific" aspects. It is time that the scientific community, and those who are students of the scientific enterprise, attend to what they can contribute. We share

unusual talents, not least in our facility in scientific language, our science literacy, and our grasp of how the scientific establishment works (in the several senses of that phrase). We need to ask how this base of knowledge *about* science and technology can be made more useful to society, how it can help citizens make better-informed decisions about acceptance or use of a technology, and how it may be used in setting national or regional priorities, assessing the quality of science, allocating scarce resources, or developing projects that will serve the interests of not only the present generation but also those to come. Concern for public impact of new technology or knowledge is not strictly a problem for the policy analysts; nor can policy analysts ignore the ethical or social aspects of the scientific enterprise. That's why we see our two sponsors as a natural combination.
—MCL

In Defense of Intangibles: The Responsibility-Feasibility Dilemma in Modern Technological Innovation

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What? Do we really want to permit existence to be degraded for us like this—reduced to a mere exercise for a calculator and an indoor diversion for mathematicians? Above all, one should not wish to divest existence of its *rich ambiguity*: that is a dictate of good taste, gentlemen, the taste of reverence for everything that lies beyond your horizon. . . . [A]n interpretation that permits counting, calculating, weighing, seeing, and touching, and nothing more—that is a crudity and naiveté, assuming that it is not a mental illness, an idiocy.

*Friedrich Nietzsche,
The Gay Science¹*

Item 1: In the early 1970's, large deposits of oil were discovered in the North Sea off the eastern shores of the Shetland Islands. Shortly thereafter, plans were announced for construction of Europe's largest and most modern oil port at Sullom Voe on the Shetland mainland. In the ensuing controversy, oil industry executives argued that "the economic spin-offs would bring 'great benefits', would 'revolutionize the economy of the islands', and would 'improve the quality of life for all Shetlanders.'"² At the same time concern was expressed by some Islanders over the impact of this technology-intensive development on their landscape, environment, and traditional way of life: predominantly rural, oriented to seafaring, herding, and cottage industries, and unified by a "collective Shetland identity,"³ shared cultural values, and stable behavioral norms.⁴

Item 2: On July 25, 1978, Louise Joy Brown was born in Bristol, England. Widely regarded as ushering in "a new era in human reproduction," the birth was "the first recorded case in which a human egg had been taken from a woman's ovary,

had been fertilized and then implanted in the woman's uterus, and had developed to term."⁵ In the controversy generated by the prediction, and then the accomplishment, of this feat, some argued that the technological procedure "gave couples suffering from several forms of sterility hope that they might have a child of their own."⁶ Others, although acknowledging the benefit of this development to such couples, expressed grave concern over its ultimate bearing on important human issues. For example, Leon Kass wrote that what is at stake is "the *idea* of the *human-ness* of our human life and the meaning of our embodiment, our sexual being, and our relation to ancestors and descendants."⁷

These cases exemplify a recurrent pattern in disputes surrounding the proposed introduction of many important technological innovations and technology-intensive developments in modern Western society. In this pattern, proponents argue that a given innovation or development will surely yield direct, concrete, demonstrable benefits realizable in the short- to intermediate-term (e.g., economic or medical benefits, as in Items 1 and 2 respectively). Opponents contend that proceeding with the innovation or development in question may produce serious costs, albeit ones which may be indirect results of the technology, ascertainable only in the long run, and intangible in nature (e.g., costs to senses of identity, self-esteem, intimacy, or community).

Attempts to resolve such disputes rationally encounter the formidable barrier of the responsibility-feasibility dilemma of modern technological innovation. On the one hand, the longer a conscientious decision-maker waits to ascertain the full range of impacts on intangibles (impacts often only slowly or indirectly revealed),

the stronger the body of evidence may be against a technology's further development, production, dissemination or use. Yet, a variety of factors makes it proportionally more difficult to decide to reject such a technology at a late date. These factors include: (a) the large human and capital investments typical of most modern technological research and development; (b) the psychological investment in an ever-expanding horizon of technological possibilities (an investment fostered in society at large by elements of the reigning cultural matrix and in professional communities by developers who have an interest in proceeding with the technology); (c) considerations of individual, group, and national prestige; and (d) the jobs dependent on maintaining and expanding the industries associated with the new technology or technological development. On the other hand, the earlier one can convincingly portray the development or dissemination of a new technology as deleterious to human well-being, the more feasible it is to attempt to alter or stop it. Yet, precisely at such times of maximal vulnerability, it is especially difficult to acquire compelling evidence of long-term effects which, although non-material in nature, pertain to making an ethically responsible decision on whether to proceed. This dilemma between responsibility and feasibility makes it difficult in capitalist, prestige-conscious, progress-oriented societies to reach decisions about new technologies and technological developments which are rational, responsible, and honest.

This situation often has additional ramifications. The second or "feasibility" horn of the above dilemma applies with particular force to citizens who do not perceive their vital interests to be at stake. Even if evidence could rapidly be adduced about probable, adverse, long-term impacts on intangibles, it would most likely go unheeded by the bulk of the uncommitted because of the predominantly materialistic bias of contemporary Western action-orienting worldviews. Such worldviews neither affirm the reality and importance of certain intangibles nor prescribe their protection or promotion. The much-heralded cultural pluralism and materialism of American society, therefore, make the second horn of the dilemma especially difficult to escape. Unless a technological development is perceived as a threat to materials or physical well-being, this pluralism-cum-materialism makes it difficult to restrict development via appeals for the protec-

tion of intangibles. For example, in the early opposition to nuclear power plants, appeals to alleged obligations to future generations clearly failed to have a serious impact on public opinion.

Moreover, if cessation or limitation of development is itself perceived as posing a threat, appeals to protect intangibles against the effects of proceeding will quite likely go unheeded. In 1971, voters in a San Francisco municipal election considered a citizen initiative ("Proposition T") which would have set a six-story or 72-foot height limit on new buildings in the City, a limit which could be exceeded only if specific voter approval was secured for a particular proposed building. Sponsors of the initiative argued that intensive highrise office building construction was destroying the character of the City and undermining the fabric of San Francisco neighborhoods. Initiative opponents contended that its passage would lead to higher property taxes and increased unemployment.⁸ The outcome: Proposition T was roundly defeated by about a two-to-one margin.⁹

For proponents of a technology or technological development who stand to profit economically from a decision to proceed, as well as for opponents who have a non-economic interest in the outcome, this second or "feasibility" horn of the dilemma frequently gives rise to ethically problematic behavior. Proponents, recognizing that appeals to the possibility of long-term negative impacts on intangibles pose potential obstacles to proceeding, sometimes attempt to cast doubt on the reality (or at least the importance) of these intangibles. The latter's allegedly tenuous ontological status is invidiously contrasted with the evident reality (and undeniable importance) of the promised short- to intermediate-term, concrete, tangible, material benefits.¹⁰ Proponents hope thereby to limit the debate to argument over which course of action—accepting, rebuffing, or rejecting the innovation—will maximize these quantifiable benefits. This tactic might be called "specious reduction", meaning that proponents aim to reduce the set of considerations deemed real and relevant to the kind just mentioned.

On the other hand, opponents recognize the difficulties for their cause posed by the lack of any shared intangible-protecting worldview. Hence, in order to maximize the public appeal of their position, they often opt disingenuously to transform their original private positions conceived at least partially in terms of threatened intangibles into public postures couched in terms of more con-

crete, material considerations about whose critical importance there is social consensus. Usually these considerations pertain directly or indirectly to the basic human needs of survival or safety. This artifice might be called "specious inflation." For example, one argument for the 1976 passage of Proposition 20, which established a permanent state committee to control development of the California coast, was a study purporting to show not that oceanic experiences had intangible inherent aesthetic and spiritual value but rather that in the long run more permanent jobs would be lost by developing the coast than by not developing it.¹¹ Similarly, in 1978 a spokesperson for a San Francisco Bay Area citizen's group concerned over the exacerbation of noise pollution through expansion of San Francisco International Airport did not couch her public argument in terms of the intangible value of tranquillity. Rather she referred to the deleterious effects of noise on property values, sleep, usable classtime in schools, and the fact that because of aircraft noise, doctors in nearby hospitals were having difficulty using their stethoscopes.¹² The claims made by these and similar opponents may or may not be true. What is noteworthy for present purposes, however, is that to increase support for their causes, they attempted to inflate the perceived stakes of the dispute to a point at which basic security and survival needs were considered to be jeopardized by approval of the innovation or development. The difficulty of directly altering operative ontologies or worldviews (in particular, what things people regard as real and precious) increases the temptation to use this strategy to enlist the support of the uncommitted. Although avoiding specious inflation in the context of technology-related decision-making strikes a welcome blow for honesty in public policy debates, it is tantamount to giving proponents a lead of several laps in what is often not a very long distance race. But do not supposedly noble purposes justify the use of such seemingly innocuous, albeit deceptive means? Not necessarily—even from a purely pragmatic point of view. For such inflation may reinforce the myopic public belief that a technology is cause for concern only to the extent that it can be shown to bear directly on the safety and (physical and economic) survival needs of the public.

In recent years, however, several social groups have opted to reject or limit technological innovations or developments that promised concrete benefits in the short run. In 1975 the predomi-

nantly Eskimo village of Igloodik (pop. 612) in the Northwest Territories voted to reject the introduction of television into the community out of concern that their culture would be "eroded" by TV.¹³ Within the Hasidic community in Brooklyn, New York City, television and birth control are proscribed, the latter prohibition derived from the Torah.¹⁴ In the case cited above as Item 1, the Shetland government succeeded in getting a bill through the British parliament to help contain and control the oil developments:

"... by law all major oil related industrial developments must be built in the Sullom Voe region. Also, in order to encourage preservation of the traditional Shetland landscape and way of life, certain areas of the islands have been designated as conservation zones where no major development, oil or otherwise, can take place."¹⁵

In these examples, we can discern the presence of a shared worldview or conception of an appropriate way of life. Such shared ideational constructs may galvanize determination to protect intangible aspects of a culture (e.g., a sense of intimate connection with ancestors, or an environment of stable, rural island life) against the long-term costs of even those technological innovations or developments that offer (from the perspectives of developers and those already possessing the innovations) clear, quantifiable benefits.

In recent years in America, some of the opposition to controversial technologies has been rooted in concern over potential long-term impacts on intangibles. For example, public opposition to granting the Concorde unrestricted landing rights has usually taken the form of claims that the plane is economically inefficient, disrupts schools, rattles homes, and will inflict damage on the ozone layer. However, to a modest degree, opposition to the Concorde also stems from general concern over Western obsession with radically telescoping time-consuming processes associated with carrying out various human activities, in this case, transport. There is apprehension that, through this cultural mania, the quality of "end-point experiences" may be diminished by the relentless application of high technology to condense (and automate) their respective antecedent instrumental processes.¹⁶

Another example: behind some concern over the safety of nuclear power, whether regarding underground waste disposal, accident, or sabotage, lies nagging doubt about the propriety of attempt-

ing to satisfy expanding energy needs by forcibly "wringing it out of nature" regardless of whatever "resistance" nature may offer to this effort. This audacious posture, viewed by some opponents as evidence of technological hubris, is seen as antithetical to ideas implicit in following "soft energy paths" (e.g., solar, wind, geothermal, hydroelectric, and oceanothermic sources of energy). Preference for technologies associated with such (recurrent) sources often derives from a vision of harmonious interaction of man and nature, in which priority is placed on "cooperating with" rather than "taming" or "controlling" nature. Even if strong evidence of the safety of nuclear power were forthcoming, such opposition would remain undaunted, for it is not based on the latest estimations of cost/benefit/risk ratios. Rather, it flows from normative conceptions of proper modes of relationship between man and nature, and thus ultimately from intangible conceptions of how human life should be lived, including notions of stewardship toward the earth and responsibility toward future generations. For reasons discussed earlier in this essay, however, such considerations rarely surface in public debate over controversial new technologies.

Is there any hope of compensating for the *a priori* advantage enjoyed in the West by most newly-introduced technological innovations or developments because of reigning cultural pluralism and materialism? At least three evolutionary stages of the relationship between technological innovations and developments on the one hand and intangible-protecting worldviews on the other can be discerned. In Stage 1 the members of a society share a worldview that protects the status of certain intangibles only by being inflexibly resistant to significant changes confronting it, as with, say, the American Amish. In Stage 2, a society—at least the members of the most modern and cosmopolitan part of it—possesses no shared intangible-protecting worldview that it can bring critically to bear on technological innovations and developments appearing on the horizon. Certain sub-cultures, however, may have such worldviews and may attempt by argument and political or economic action to pressure society to adopt policies consistent with their respective worldviews. This is the stage that exists in the U.S. today, where to the extent that there is a shared, operative worldview or life-outlook it is basically materialistic in nature. Religious convictions of subgroups, however, are rarely brought critically

to bear on issues in other spheres of human activity into which new technologies and technological developments are introduced (controversies over life-prolonging and life-extinguishing technologies forming a noteworthy category of exceptions to this rule).

Stage 3, a kind of Hegelian synthesis of (antithetic) Stages 1 and 2, has only recently shown signs of emerging. Like Stage 1, its disciples believe in the reality and importance of certain non-material phenomena, ones they deem critical to the quality of human existence. Unlike Stage 1, however, in Stage 3 that belief is not part of a totalistic religious worldview dictating categorical resistance to substantial changes in a way of life, including changes spawned by technological innovations. Stage 3's focus is on existence in this world, but its predominant orientation is not materialistic in nature. Stage 3 involves what might be called "secular" or "this-worldly" spirituality, characterized in part by an anti-reductionist recognition of the mutual importance, interdependence, and interpenetration (in *this* world) of matters material and spiritual, tangible and intangible. Even when in full bloom, Stage 3 will be embodied in a relatively modest number of individuals, persons not wholly wedded to the mainstream materialism of modern Western industrial society. These individuals, not united by any common religious affiliation, come by various routes to a conscious belief in the reality and importance of certain intangible phenomena and resolve to discriminate among technological innovations and developments partly on the basis of their likely impact on these intangibles. There is growing recognition that protection of the fragile yet vital status of intangible phenomena may dictate rejecting (or altering the mode of introduction or regulating the use of) certain technologies or technological developments in spite of the concrete benefits they may confer. Because of that fragility, aggregating seemingly insignificant individual costs to intangibles over a large number of situations (in each of which concrete benefits derive from proceeding with some technology) may nevertheless reap a grim harvest for the human condition.

The "discriminating sentinel" posture of Stage 3 attempts to navigate between indiscriminating and, for contemporary industrial society, unworkable extremes: the blanket, outright rejection of new technology characteristic of some traditional societies,¹⁷ and the largely uncritical technological optimism of developed industrial societies.

The resolve to protect valued intangible aspects of human life against even beneficial technological innovations and developments is a posture that seems to emerge only in the wake of some form of personal encounter with the spiritual drought of technological fetishism and its associated materialistic worldview. There is modest evidence, however, that Stage 3 is dawning, and that American society, in particular, is on the verge of a fresh recognition of an enhanced concern for the status of perennial intangible values.¹⁸ This recognition may afford one way of easing the responsibility-feasibility dilemma of modern technology, as exemplified in the 1978 California Redwood National Park Expansion bill.¹⁹ This bill provided \$359 million for the purchase and incorporation into the Park of 48,000 acres, including extensive redwood timberlands owned by several private logging companies. The legislation was passed despite expected lumber industry projections of serious economic harm. Surprisingly and significantly, the bill's Senate sponsor, Alan Cranston of California, justified his position in terms of intangible phenomena:

Redwoods . . . are not just a California resource but a *national heritage*. Preserving them is not just a California problem but a national challenge . . . Few human experiences compare to *standing within a grove of those ancient redwoods, where the light is a dim cathedral luminescence broken by occasional beams of sunlight filtering through to the forest floor*. In 1820, when California logging began, there were 2,000,000 acres of redwoods in a strip extending from the Big Sur country south of San Francisco into northern California, the far North. Today, less than 270,000 acres of virgin redwoods still stand. And all but a few thousand acres stand in danger of *desecration* by the end of this century . . . As a Nation, we sometimes too easily use superlatives without thinking about what they mean. And so *the idea of saving the world's tallest trees* may not have immediate significance when we hear the words. But think about it: The tallest living things — the greatest expanse of life from deep within our Earth, stretching into the heavens. *What better symbol is there for the eternal struggle of things to live, to grow, and to improve*. These trees are *the tap roots of eternity*. To lose them would be to lose part of *that divine spark which must inspire all of the work of man and nature*. Surely in this eighth decade of the 20th century we can resolve the economic problems of a few hundred men and women without destroying these creations of the ages.^{20, 21} (emphasis added)

Apropos of this last sentence, an important and innovative feature of the legislation is the inclusion of a number of measures designed to mitigate adverse effects on the local economy which may result from limiting lumbering, including a \$33 million land rehabilitation program aimed at retraining and reemploying displaced lumbermen.

Thus, in some cases, a partial escape from the feasibility-responsibility dilemma may lie in the emergence of a growing number of influential "Stage 3" individuals, coupled with equitable compensation for economically injured parties. Attempts to ban or limit new *medical* technologies, and thus to deprive would-be recipients of short-term, palpable *medical* benefits out of concern for allegedly threatened intangibles face considerably greater difficulties. Determining equivalent compensations for the loss of such precious benefits is a formidable if not insuperable task. Moreover, given the fragmentation and materialism of the reigning cultural matrix, the chances of such technologies being rejected are miniscule.²² As Leon Kass observes, "It is hard to get many people to take seriously such 'soft' matters as lineage, identity, respect, and self-respect when they are in tension with such 'hard' matters as a cure for infertility or new methods of contraception."²³ Nonetheless, responsible reflection on a new technology by citizens and decision-makers requires attending to its bearing on the status of important intangibles. In this connection, as individuals and as a society, we would do well to bear in mind Thoreau's prescient contribution to a more comprehensive model of cost/benefit analysis. "The cost of a thing" he asserted, is "the amount of what I will call life which is required to be exchanged for it, immediately or in the long run."²⁴

NOTES

1. Friedrich Nietzsche, *The Gay Science*, edited and translated by W. Kaufmann (New York: Vintage Books, 1974), Section 373, p. 335.
2. *New Scientist* (19 April 1979): 183.
3. D. H. Rosen and D. J. Voorhees-Rosen, "The Shetland Islands: the Effects of Social and Ecological Change on Mental Health," *2 Culture, Medicine and Psychiatry* 1: 49.
4. Since the terminal at Sullom Voe opened in

- November 1978, considerable damage has been done to Shetland wildlife and coastal environment. Two factors are to blame: "the discharge of oil-contaminated ballast water by incoming tankers" and an accident at the Sullom Voe terminal on 30 December 1978 involving the 193,000 dwt Esso *Bernicia*, the largest tanker to have entered Sullom Voe to that date. When a fire broke out in the engine room of the stern tug, obliging it to slip her mooring lines, the *Bernicia* crashed into three mooring dolphins and a jetty, discharging 1,174 tons of bunker C fuel into the Voe. These discharges resulted in the deaths of thousands of oil-covered birds as well as otters and sheep. "Initially about 20 sheep died and the fleeces of 2,000 or so ruined by the oil; a further 4,000 or so were also at risk. Foreshore grazing is an important part of the winter food supply of the true Shetland breed of sheep, but now at least 24 km of the coastline of west Yell must be fenced to keep sheep away from the contaminated seaweed. Animals taken from the foreshore to inbye land soon after the accident were starting to die eight weeks later, and post mortems revealed oil in their stomachs." In addition, a number of otters and thousands of oiled birds (including 160 rare great northern divers) died. *New Scientist* (19 April 1979): 184; and *New Scientist* (26 April 1979): 261.
5. Clifford Grobstein, "External Human Fertilization," 240 *Scientific American* 6 (June 1979): 57.
 6. *Ibid.*
 7. Leon Kass, "'Making Babies' Revisited," *Public Interest* 54 (Winter 1978-79): 35.
 8. *The New York Times* (1 November 1971): 48.
 9. *The New York Times* (3 November 1971): 32.
 10. For examples of this tactic, see Note #21 (below) to the discussion of the dispute between supporters and opponents of federal legislation expanding the California Redwood National Forest.
 11. Olive Mayer *et al.*, "The Employment Impact of the California Coastal Plan," an unpublished study written for the California State Legislative Analyst's Office (11 May 1976).
 12. Anita Maraviglia, "Citizens Battle Back on Plane Racket," *San Francisco Examiner* (15 March 1978): Section C, p. 2.
 13. *San Francisco Chronicle* (19 March 1975): 17.
 14. Stephen Isaacs, "Hasidim of Brooklyn: Fundamentalists Jews Amid a Slumscape," *Washington Post*, Outlook Section (17 February 1974).
 15. D. H. Rosen and D. J. Voorhees-Rosen, *op. cit.* (Note 3), p. 49.
 16. Concern over microwave ovens, to take another example, derives not just from uncertainty about the physiological effects of microwave radiation but also from aversion to the intangible cultural costs of radically compressing food-preparation processes. More generally, there is growing apprehension over the possible long-term intangible psychic costs of cultural impatience with slow processes of gestation or unfolding.
 17. See, e.g., Lauriston Sharp, "Steel Axes for Stone Age Australians," in *Human Problems in Technological Change: A Casebook*, E. H. Spicer, ed. (New York: John Wiley, 1962), p. 87.
 18. Perhaps because of increasing personal experience of the damage to the fabric of everyday existence in twentieth-century America resulting from diligent disregard of perennial intangibles in the insatiable pursuit of greater economic growth.
 19. *The New York Times* (10 February 1978): 17.
 20. *Congressional Record - Senate* (31 January 1978): S933-34.
 21. Some comments made in the course of this dispute illustrate the tactic of "specious reduction." For example, in rebutting Senator Cranston's argument — one couched, as we have seen, in terms usually associated with spiritual and religious discourse and phenomena — Mayor Samuel Sacco of Eureka (the largest city in the northern California lumbering area containing the Redwood Forest) stated sardonically: "I hope you will come to church here some Sunday and sit with the working people who have lost their jobs and are living on \$105 (a week) unemployment." [*Palo Alto Times*, (1 February 1978): p. 1]. Another example: in the Senate debate on the Cranston bill, Senator Robert Dole of Kansas argued: "[O]ur choice is not one between trees and no trees; it is a choice between trees and money, trees and jobs, trees and people. I have never advocated environmental callousness, but I believe that in an area where 80 percent of the population make their livelihood from the timber industry, it makes little sense to beleaguer families and communities

with nonessential preservationist causes" [*Congressional Record – Senate* (31 January 1978): S957].

22. Confirmation for this claim can be found in the U.S. Department of Health, Education and Welfare Ethics Advisory Board decision in March 1979 to approve (conditionally) proposed research into the laboratory fertilization and artificial implantation of embryos with a view toward perfecting the technique of *in vitro* fertilization for women wishing to become pregnant. For background on the creation of the Board, see Kass, *op. cit.* (Note 7), pp. 33-34. One of the conditions stipulated by the

Board in approving this research is that "participants and the public will be advised if evidence begins to show ill effects from such research" [*The New York Times* (17 March 1979): 6]. However, the "ill effects" the Board has in mind apparently do not include the possible long-range indirect effects of this research on intangibles of the sort discussed by Kass, *op. cit.* (Note 7), pp. 59-60.

23. Kass, *op. cit.* (Note 7), p. 59.
24. *Thoreau: Walden and Other Writings*, Joseph W. Krutch, ed. (New York: Bantam Books, 1962), p. 128.

Analysing Symbolic Dimensions of Technological Disputes: The Michigan Container Controversy

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Part I of the following paper focuses on a specific case study in the social confrontation of science, technology, and values—a political controversy over state regulation of returnable beverage containers. In Part II, the methodology and theoretical assumptions used in this and similar studies by the authors are described in broad terms in an effort to foster discussions on methodological and theoretical approaches to the study of science, technology and human values.

Part I

Case Study: The Michigan Container Controversy

The passage of Michigan's "Bottle Bill Referendum" in November 1976, ended a major battle in the environmental wars of the 1970's.¹ A neo-progressive coalition of environmentalists, government officials, civic groups and editorial writers backed the initiative. They claimed that a switch from throwaway to returnable beverage containers would decrease litter, save energy and resources, create jobs, and reduce beverage prices. Their opponents—mainly brewers, bottlers, distributors, retailers, container manufacturers and affected labor groups—countered that litter would not be significantly reduced, nor energy saved. However, jobs, sales, and state tax revenues would be lost if the proposal passed.

The Michigan bottle battle was fought in two different but interpenetrating contexts. In the first, the environmental costs versus the economic

benefits and convenience of the throwaway were debated—the same kinds of issues that had already been confronted hundreds of times in the 1960's and 1970's in environmental legislation and litigation. But in a larger, symbolic context, the throwaway and its slogan, "No Deposit, No Return," had become the focus of a battle over opposing technological styles and the values supporting them.² Industry lauded throwaways—and the centralized, capital and energy intensive technology they represented—as testaments to American technical genius and affluence. Environmentalists saw in them an indictment of a destructive, throwaway society.³ Therefore, the campaign touched almost everyone in many ways. And it was fought with an intensity—an outlay of emotion and money—that, in Michigan, often overshadowed the Presidential race.

The battle began with a barrage of statistics. Although in both number and quality the environmentalists' studies were more substantial, a weary public seemed to disregard the statistics emanating from both camps.⁴ Indeed, most principals in the campaign seem to have read only summaries of these studies and were quick to denounce conclusions with which they did not agree, even when the study had been commissioned by their own organization.⁵ In short, everyone was sure he was right, independent of the empirical evidence.

In the heat of charges, counter-charges, and conflicting interpretation of evidence, the debate often transcended the immediate issues to focus on American goals and values and their relationship to various technological styles. For environmentalists, the bottles and cans strewn across the countryside had become worldwide symbols of America's orgy of consumption and

waste. What one industry official had called the "miracle" of American distribution and packaging was for them a source of anger and shame.⁶ In a world of exploding population and shrinking resources, economic expansion achieved by sophisticated packaging (rather than product improvement) and by stimulating desire far beyond legitimate need was outrageous. "Convenience" had come to mean an abdication of conscience.⁷

In many ways the throwaway container was a perfect springboard for this broader, symbolic campaign. It was an icon of American life that everyone used and recognized and therefore was an obvious target for environmental activists. Centralized production in the brewing and soft drink industries provided convenient villains: big business and runaway technology.⁸ Widespread use of throwaways (at the time of the election about eighty percent of the market for beer and sixty percent for soft drinks) was a relatively recent phenomenon and people could recall an alternative to throwaways which was associated in many minds with a simpler, less hectic past.⁹ The prospect of returning containers to the store for reuse also offered each person a sense of direct involvement in protecting the environment without necessarily altering his lifestyle. Finally, it was argued that throwaways cheated the public by shifting industry's solid waste costs to the public tax rolls, by raising consumer prices because throwaway packaging is more expensive than returnable containers, and by decreasing jobs because throwaway packaging is less labor-intensive. The throwaway was, as one newspaper editorialized, "the most glaring example of America's trash-oriented society." In attacking the non-returnable container, environmentalists were attacking a way of life. *The New York Times* observed that the attempt to ban the throwaway and "to reverse the throwaway lifestyle in a sense represents the farthest reach of the six-year-old environmental 'revolution' in that it seeks not simply to protect natural values but to alter a pattern of commerce tacitly supported by the economic system and public acceptance."¹⁰ Rejecting the throwaway was a chance to begin redressing the myriad environmental and social problems that had, in one politician's view, "been spawned by the idolatry of technology."¹¹

What the environmentalists rejected, industry representatives embraced as proof of American ingenuity and efficiency. Convenience packaging was a triumph of the free enterprise partnership

between consumer and producer. And continuing technological innovation and sales growth in the industry confirmed the success of "the American Way," a symbolic phrase signifying in industry parlance the creed of progress and the free enterprise system, as well as the American rapidly paced lifestyle. To renounce the technological and economic progress achieved in packaging and marketing would be, industry ads repeatedly declared, "a giant step backwards."¹² "Without packaging, we'd still be brushing our teeth with table salt, working up lather in a shaving mug, and shooing flies in the meat market . . . [and] without the assurance of sealed packaging, the Pure Food and Drug Law—the nation's first consumer protection measure—would be inoperative."¹³

From industry's perspective, banning the throwaway and related packaging would not only disrupt the American lifestyle, but would also mark the beginning of a potentially disastrous trend of technical and economic stagnation or contraction. The Chairman of the U.S. Brewers Association observed that the "bottle battle" was "symbolic perhaps of a no-growth society. . . . I think we here in Michigan have to ask ourselves whether the solutions to our social, racial and employment problems can ever be equitably solved in a 'no-growth' framework."¹⁴ In addition, bottle bills set a dangerous precedent for government intervention in the free market by dictating the packaging and marketing of industrial products in a way that could undermine both business and consumer freedom. More basically, restricting throwaways was philosophically objectionable and impracticable. The source reduction approach to solid wastes—the approach embodied in the bottle bills—would impede technological and economic growth necessary to our way of life. It was a counterproductive attack on only a small part of the total problem. What industry wanted was a solution that (1) used economic incentives rather than restrictive legislation, (2) spread the economic burdens fairly among producers of waste, and (3) promoted economic expansion rather than contraction. They proposed a "litter tax" that would apply to all sources of litter, and they insisted that the psychology of litter had to be reversed by educational programs before lasting reductions in litter could be achieved. However, the long-term solution lay in resource recovery—massive municipal recycling projects that would not only reclaim aluminum, ferrous metals and glass but, in the burning of plastic and

paper residues comprising forty-three percent of the solid waste stream, also produce energy.¹⁵ Industry saw this as a progressive solution that would mandate important technological innovation, economic growth, new jobs, and sustain the American way of life.¹⁶

Based on their impressive record of defeating container legislation in other states and localities, industry should have won the Michigan campaign. National industry groups had both money and political experience to contribute. The Committee Against Forced Deposits (CAFD) was prepared to outspend their opposition by a very large margin.¹⁷ Moreover, they were accustomed to trailing initially in opinion polls and then reversing the deficit with sophisticated advertising and public relations. Finally, they were arguing their case in a highly industrialized, unionized state that should have been receptive to their economic arguments. Nevertheless, the bottle referendum passed by nearly a two-to-one margin.

A few key factors combined to produce the environmentalists' victory. The backers of the referendum were extraordinarily well-organized, and drew on the resources of a 100,000-member grassroots organization, the Michigan United Conservation Clubs (MUCC). They had the nearly universal backing of the state's press and governmental apparatus. Moreover, the tide of history seemed to be running in their favor. Changing attitudes toward the environment and technology, and on what constituted "the good life" coalesced, at least for the moment, to strengthen the environmentalists' position.

Evaluating the Symbolic Referendum

In weighing the various components that combined to insure the passage of the referendum, it is clear that the symbolic level of the campaign was the most important. Despite constant reference to analyses of the economic, resource, energy, and litter issues, such empirical evidence as existed was not crucial. Studies were used to buttress rather than to form or reshape opinion,¹⁸ partly because of an unavoidable inadequacy in the studies themselves. There were significant gaps in the relevant economic and environmental data. In addition, all the studies were based, of necessity,

on challengeable assumptions about future technical developments, economic patterns, and consumer behavior.

More importantly, no empirical evidence of any kind can account for what one former state legislator recently called "the savagery" with which the campaign was fought.¹⁹ In fact, within the context of the current U.S. economy, throwaways are only minimal consumers of energy and natural resources.²⁰ The raw materials used in the manufacture of glass and aluminum containers are among the most plentiful substances in the world, and steel is far from being a scarce resource. In addition, the energy requirements of the entire beverage industry represent less than one percent of the national energy consumption. But the specter of the wasteful society symbolized by throwaways littering the landscape was disturbing enough to generate decisive voter response. Not far beneath the surface of many recent environmental campaigns are sweeping challenges to the dominant economic and technological style of modern America. Implicit in these challenges are strategies for shaping alternative futures. Many environmentalists explicitly called the bottle proposal a referendum on the throwaway society. Former Oregon governor Tom McCall, while campaigning in Michigan, spoke of the transition from a throwaway society to a "husbanding society."²¹ Major elements of this "husbanding society" were clear to bottle bill opponents as well as supporters. William Sadd, former President of the Glass Container Manufacturers Institute, observed that the source reduction philosophy of the bottle referendum envisioned a "utopian" society whose goals were "reduced population, depleting finite resources at a slower rate, having more leisure time, and approaching an equilibrium with nature so as to maximize the lifespan of the finite resources of the planet earth."²² Others would add that the new social order would also be characterized by labor-intensive technologies under the control of decentralized economic and governmental institutions.

Only within the last decade could such a vision appeal to a broad spectrum of Americans. By the mid-1960's important streams of ideas and events began to converge which encouraged the consideration of alternative futures. Predominant among these were a revitalized environmental tradition, radical humanism with its sense of technological oppression, the consumer movement, and the hostility to big government and big business gener-

ated by the anti-war movement.²³

Moreover, popularization of these ideas encouraged a wider range of people to see a series of environmental and political events during the 1960's and 1970's not as random occurrences but as part of a larger pattern of technical and social failure. Events such as oil spills, industrial carcinogens in the environment, and the SST protests combined to call into question the wisdom of the accepted technological style, the viability of the economic and political institutions associated with it, and, more fundamentally, the myth of progress itself.²⁴ The bottle bill referendum gave Michigan voters the opportunity to focus their frustration and concern on a symbol of this larger set of problems. The litter, energy, and waste issues associated with the throwaway container, important in themselves, became compelling in this larger context.

During the past twenty years an increasing number of scholars and social critics have posited the emergence of what Clifton Fadiman recently called a "new culture phase."²⁵ From Ellul to Mumford to Herman Kahn, conceptions of the new culture differ radically, but they all share the perception that it will be shaped by one technological style or another. Some like Herman Kahn or Samuel Florman reaffirm the myth of progress, believing that the solution to our environmental, social, and economic problems lies in the further extension of our capital-intensive, hierarchically organized technological style. Others, such as radical humanist Theodore Roszak, neo-Marxist David Dickson, or the more traditional, liberal scholar, Elting E. Morison, share the sense that the combination of present technology and the values which guide it are profoundly dysfunctional²⁶ and that, if continued, they might well lead to both environmental disaster and political oppression. The success of citizen groups, environmentalists, and legal and scientific public-interest organizations in challenging the ABM, the SST, and the extension of interstate highways through urban areas, as well as the increasingly radical opposition to nuclear power plants, demonstrates a degree of public acceptance for this line of argument. But do these scattered challenges, including the Michigan bottle battle, represent a groundswell of support for a fundamental shift in technological style?

Politically, the lop-sided victory in Michigan has been followed by a modest series of developments in other states rather than by the landslide of restrictive legislation that its supporters

looked for and its opponents feared. Within Michigan only a small increase in the use of returnable containers occurred in the long interim period before the legislation became effective on 3 December 1978.²⁷ It seems likely that for some of those favoring the referendum, voting represented a welcome catharsis—a gesture that allowed citizens to feel environmentally responsible without accepting any real inconvenience—rather than an ongoing commitment. But for many bottle bill proponents, the act of voting may have represented a strong commitment to the "husbanding society." For these people the referendum was not just a gesture but a meaningful, if small, step in the right direction. They voted not so much for the savings in energy and resources, or the reduction of litter, as for an alternate set of values and the public's right to reverse an established way of doing things.

This assertion is supported by developments during the eight months since the law took effect. Although prices have increased noticeably (questions about the cause of the increase have generated a lively political dispute) and most consumers view the returnable system as an inconvenience, initial surveys indicate that the bottle bill would pass again easily. Moreover, an industry campaign to repeal the legislation began noisily in January 1979 only to be abandoned quietly in the spring.

For the most committed of the bottle bill supporters the ultimate test is not the fate of Michigan's referendum or whether more states eventually adopt restrictive container legislation, but whether society as a whole begins to move toward low-energy, environmentally-gentle, labor-intensive, decentralized technologies in an increasingly broad range of industrial and commercial areas.²⁸ Viewed in this larger context, advocates of passive solar energy and organic farming, anti-nuclear groups, and bottle bill supporters share the same vision of the appropriate technological style.

When William Sadd characterized the advocates of container legislation as seekers of a utopian society, he meant to suggest the impracticality, judged by his standards, of the suggestions of these true believers. Granting his version of the good society, Sadd, of course, was right. But his opponents might with equal justice point out that the rhetoric and the arguments of the defenders of the disposable container also reflected a real, if different, utopianism.²⁹ The advocates of high technological style and its supporting myth of

progress were able to garner barely more than one-third of the total vote, one more piece of evidence that the ideas which have long supplied a major part of the dynamism of the American experience have faltered badly in their ability to evoke and sustain a believable vision of the good society. Without such a vision, or an alternative one, the task of framing effective and acceptable strategies for dealing with problems of employment, or energy, or development becomes extraordinarily difficult.³⁰

The Michigan referendum provided a well-defined but limited terrain on which advocates of two very different views of America's future could join battle. While the defenders of high technology lost this battle decisively, the broader significance of their loss in the war of technological styles is far from clear. Litter has decreased with Michigan's switch to a returnable system, but the results of the symbolic referendum that energized the campaign remain ambiguous.

Part II

Methodological Techniques for the Study of Science, Technology and Human Values

The study of science, technology, and human values has been characterized by a lack of consensus or significant discussion about appropriate methodological and theoretical approaches. It is therefore not surprising that the most successful research expository format has been the case study. Topics such as nuclear power, DDT, or the Michigan bottle bill offer the substantial benefits of relatively automatic definition of research boundaries and the potential of broad intrinsic interest. However, even case studies cannot be written without explicit (or, more often, implicit) theoretical assumptions that shape the questions asked and differentiate the significant from the trivial. Beyond that, research techniques are essential in translating vast amounts of scholarly material into useable information.

Like many others, we have adopted the case study format and for the past five years have been developing a series of studies exploring the links

between technology and culture. While we have drawn upon the work of many social scientists (early in our work Neil Smelser's discussion of structural differentiation in *Social Change in the Industrial Revolution* and the work of Peter Berger and Thomas Luckmann in *The Social Construction of Reality* were particularly helpful), our approach has been most significantly affected by the theoretical perspectives and methodological techniques developed in the fields of American Studies and Popular Culture Studies. Topically and chronologically, we have explored several major American institutions of the nineteenth and twentieth centuries, rather than specializing in one type of case study (e.g., contemporary controversies involving science and technology). In the process, we have tried to move back and forth between two different but complementary modes of scholarship. Through tightly focused case studies we have examined the role of technology in American culture in a wide variety of situations. At the same time, we have used each study to test and refine our research methods and to develop a working model of the relationships linking the physical, social, and symbolic universes that compose the world of culture. While there is much we do not understand about the causal processes linking the various components of our model, the following remarks describe briefly our basic assumptions and some of the implications of our research program. They are offered as a contribution to continuing discussion of the methods and theories appropriate to research in the area of science, technology, and human values.

Learning From the Michigan Referendum

One of the strengths of the case study format is the way in which a limited arena becomes a microcosm illuminating more complex patterns of cultural change in the larger society. This is particularly true when the object of study is a controversy, hearing, or trial—that is, some episode of stress where potential and often unrecognized conflicts of policy, values, and experience becomes dramatically visible.

The Michigan container controversy is one of the simplest and most easily understood members

of a family of complex controversies—battles of technological styles—which includes nuclear power, synfuels, DDT, and others. Compared to these cases, the technical aspects of the Michigan controversy are relatively uncomplicated and therefore allow the non-technical dimensions of the dispute to be highlighted. Consequently, the importance of the Michigan study lies in what it has to teach us about the symbolic dimensions of such controversies. Deciding what is the “appropriate” technology or the “appropriate” policy is a value-laden question. Sound technical information is important; but everyone assesses technical information within a matrix shaped by his or her ideological and, we would argue, mythic commitments. This assertion is based on several central concepts and theories outlined below.

Controlling Concepts

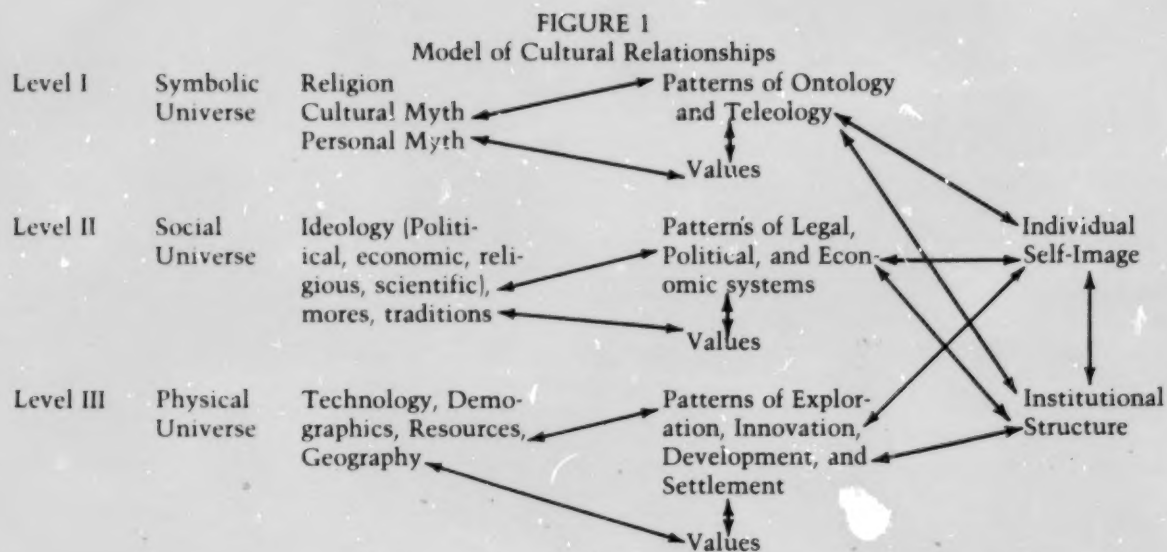
Cultural Myth: Conventional technology and culture studies focus primarily on the interaction between technology and the manifest social world.³¹ Many scholars omit consideration of myth because they do not believe it plays the significant role in modern cultures which it once played in primitive societies. The scientific revolution of the sixteenth and seventeenth centuries, they believe, encouraged the irrevocable substitution of ideology for myth, art for religion, and natural event for mystery. Nevertheless, our case studies have convinced us that myth persists as a powerful, formative element of culture. Myth-making, we believe, is a reflexive gesture of the human mind that energizes and gives direction to culture. As the psychiatrist Harry Stack Sullivan once observed, “the dynamics of culture are in the unwitting part of it,” a point verified by the typically moribund nature of “planned” societies.

Modern cultural myths appear to arise spontaneously. The most powerful are accepted uncritically and often unconsciously by members of both popular and elite culture. They are loose narrative structures woven around a central cluster of images, symbols, and metaphors which appeal to several levels of consciousness. They impose moral order and meaning on history and portray desired futures. Into the broad and necessarily

loose cultural “plots” or “scenarios” provided by these myths (e.g., progress or the agrarian utopia) the individual fits his own experience, unites the everyday with the millennial, and internalizes—to a degree that depends on his relationship to the myth—a discrete and value-laden perspective on human affairs. In our secularized society, cultural myths often function in ways analogous to religion in traditional societies.

Periods of social stress and cultural dislocation can often be understood in terms of the waning of one dominant cultural myth and the waxing of another. The myth of progress which undergirded first the growth of industrialism, and later that of high technology, appears increasingly less viable. In the Michigan bottle controversy, industry spokesmen continually but unsuccessfully appealed to “progress” and “the American way” in an attempt to win support not only for throwaways but for some deeper commitment to technical and economic growth. The full dimensions of the waxing, competing myth are not yet clear. It is associated with a “slow or no growth” society characterized by “alternative” technology, decentralized social structures, and perhaps a neo-agrarianism. Whether this emerging myth will become dominant, atrophy, or somehow merge with the myth of progress is not yet clear. But the present competition of these two myths, obvious in the bottle battle, provides an interesting context in which to understand this and related controversies.

Technological Style: By “style” we mean the manner or mode in which the symbolic, social, and material elements of culture interact and express themselves. In modern industrial society, technology is, we believe, a primary determinant of political and economic ideology and institutional structure, and strongly influences the symbolic dimensions of culture. In fact, technology is often implicitly or explicitly defined in scholarship to include not only tools, but technical knowledge, facilitating social structures, and even ideology as well. Therefore, to speak of a “technological style” is to indicate a family of mutually supporting technologies and social organizations bound together by a web of ideological commitments and cultural myths to form a cultural mode which (a) justifies the use of the technologies; (b) legitimates the educational, economic, productive, and governmental organizations needed to support the technologies; and (c)



provides meaning for the lives of individuals who participate in these organizations.³² Therefore, technologies and technological styles are never value-neutral; rather, they impose values and structures on society. They are not autonomous, however. They are shaped and directed in their interaction with other elements of culture, just as they, in turn, shape them.

Ideology: The term "ideology" is so widely and variously used that the sense in which we understand the concept should be stated to avoid confusion. In our study, ideology is the explicit analysis of a society and its history in a way that justifies certain values and goals and that specifies the social *modus operandi* through which those goals may be achieved.

Model of Cultural Relationships

Basic to our understanding of cultural myth, technological style, and ideology is the assumption that there are identifiable paths along which these elements interact in the process of cultural change. We have utilized a fairly standard three-tiered model to help illustrate such patterns.³³

Generally speaking, the first level, the mythopoetic or symbolic universe, provides the meaning and sense of purpose—the metaphysical

glue—which hold a society together.³⁴ Cultural myths are sometimes invoked explicitly (e.g., the American Dream), but more often they are implicit or foundational assumptions of the culture. The social universe, the second level in the model, is held together by ideology, which is the culture's foundational assumptions made manifest. The social universe has its own symbol systems, of course, but they are usually more rational (or quasi-rational) and explicit than are cultural myths. Together, the symbolic and social universes provide the basis through which a culture interacts with the physical world, mainly through technology—which is unique among man's creations in that it is the one product of the first two levels of culture that both changes the physical world and sometimes seems to take on a life of its own.

It is, of course, one thing to lay out and define terms for a static model of cultural relationships, and quite another to specify how they interact in the process of cultural change. In our work to date we have become firmly convinced of two things: (1) that these several strata of culture interact in varied and complex ways we are just beginning to understand and, by extension, (2) that most current theories oversimplify these interactions, especially when they ignore the symbolic level of culture.

At present, we are working with the following hypothesis regarding the process of cultural change: A significant change in any level of the

model eventually affects not only individual self-image and institutional structure but also the other two levels of the diagram. What might be called the primary wave of cultural change is usually initiated on the *left* side of Figure 1 with changes in either cultural myths, or scientific/economic/political ideas, or in technical/resources/demographic developments. When changes in one level affect individual self-image and institutional structure, the other two levels are subsequently affected. These secondary changes move back across the diagram from *right* to *left*.

When these three levels of culture function synergistically, a powerful cultural mode, or technological style is created. But if there is significant dissonance between the levels—as when (a) a society loses its sense of identity and purpose, (b) a political or religious ideology becomes destructive, or (c) a society slips out of balance with the physical world through over-population, exhaustion of natural resources, or pollution—then major and perhaps convulsive cultural change is imminent. The situation is made more complex by the fact that a rapid and perhaps accelerating pace of cultural change appears to be an inevitable by-product of the high technological style.

Materials and Methods

The footnotes to Part I of this article indicate the range of materials we use. In general, they fall into three broad categories: technical and scholarly literature, popular materials, and legislative hearings and statements by public figures—each requiring different methods of analysis.

Technical and Scholarly Literature: Our approach to these materials is conventional. We try to find studies representing a variety of positions and to read them critically—looking for consistency in the way the problem is defined and the assumptions made at key points in the argument. In the bottle referendum, the technical reports from the various state and national governmental units, environmental groups, and industry were particularly interesting because, despite the use of impressive amounts of statistical data, the conclusions of these reports—favorable or unfavorable to various container systems—were determined by

controversial assumptions of future changes in technical, economic, and behavioral parameters. In general, the more crucial such assumptions become to the study's conclusions, the clearer is the nexus of technology, values, and cultural goals for both sponsors and researchers.

Popular Materials: This category includes the popular arts, articles in non-scholarly magazines, newspaper reports and editorials, letters to the editor, opinion polls, and advertisements of all kinds.³⁵ Popular materials are particularly important to this type of research because they (a) reflect the conscious and unconscious beliefs and concerns of their audiences, (b) are primary carriers of cultural myths, and (c) propose solutions to social dislocation—like that caused by the continual process of technical change—in ways that are consonant with traditional beliefs and values.

Popular materials revolve around a central core of symbols and metaphors linked together in formulaic patterns, scenarios, or plots. In the aggregate, these symbols, metaphors, and formulas inform the dominant cultural myths of an era. Their importance and power derive from their ability—whether they appear in print, graphics, or electronic media—to integrate the rational and suprarational, the abstract and concrete, and to make meaningful the disparate patterns of individual and social experience. These materials quickly portray developments that threaten the cultural *status quo*. The themes, imparted by symbol and formula, represent attempts to resolve cultural conflicts in a manner harmonious with accepted beliefs and values. This accommodation may be achieved or the force of change may be powerful enough to introduce new patterns of living and values. Occasionally, extant cultural values may completely block change. In any case, popular materials carefully used offer an invaluable window on the imaginative reaction of a society under the stress of technical and cultural change.

Legislative Hearings and Statements by Public Figures: As controversies develop, public figures emerge as spokesmen for various constituencies. Their pronouncements are often strongly ideological—overt attempts to shape public opinion and policy toward explicit social goals. Statements from the same public figures may appear in the transcripts of legislative hearings. More often, the hearings are dominated by the testimony and exhibits of individuals and groups who are deeply involved in the controversy but largely unknown

to the general public. Hearings provide a stage analogous to that provided public figures in the mass media, and the results are similar. Transcripts of congressional and state hearings are a rich source of ideological statements that often emphasize the connection between particular kinds of technology, institutions, and values.

Concluding Comments

In the process of assembling a case study, we constantly move backward and forward from material to model to material assessing what is useful, what kinds of materials are particularly rich sources of information, and whether there is adequate information to understand the key components for each level of our model. Initially, the result resembles a disordered and incomplete mosaic made up of many fragmentary views combining economics, technical data, historical understanding, and visions of the future. As we attempt to integrate these fragments, we give serious attention to materials and scholarship belonging to the physical and social universes. However, our major interest is the relationship between events on these two levels and what we believe is the crucial but still poorly understood stratum of the symbolic universe. The cultural myths of the symbolic level often give meaning and coherence to the patterns of agreement, disagreement, and confusion which characterize public controversy related to science and technology. Most research in this area crisscrosses only the terrain of the social and the physical universes. In many instances—perhaps most—such an approach is appropriate. However, analysis of controversy or public policy for science and technology must also recognize and make allowance for the symbolic universe. Cultural myths, through their central core of images, symbols, and metaphors, evoke emotion and give direction to public opinion. They do this by providing a vague but pervasive sense of appropriateness for the values, actions, institutions, and technologies that are consistent with the reading of the past and the vision of the future each myth projects. Technological styles rest on metaphysical foundations provided by cultural myth. This means in part that individuals or groups committed to conflicting cultural myths

(e.g., progress vs. the agrarian utopia) are unlikely to agree on, for example, the appropriate role of nuclear power or synfuels in America's energy future.

We have just begun to probe the elements of our model and we expect its details will be modified as we better understand the interrelationships linking its parts. But we are convinced of one thing—that we live in a period in which fundamental doubts have been raised about some of the most basic assumptions giving coherence and order to our industrialized culture. The myth of progress with its associated images of the past and vision of the future is no longer compelling to a growing proportion of the American people. What, if anything, will take its place is not clear. What is clear to us, as we attempt to understand the relationship between science, technology, and human values, is the importance of recognizing the role of the symbolic universe in shaping many contemporary public policy controversies.

NOTES

1. Until April 1976, Michigan environmentalists had concentrated on legislative channels in their efforts to pass a bottle bill. As early as 1965, State Legislator Robert Slingerland had introduced restrictive container legislation; but this and subsequent efforts in the early 1970's by Representative Lynn Jondahl to pass bottle bills had met with frustration as industry and labor lobbyists successfully blocked the legislation at the committee level. By 1974, there was grass-roots agitation within the 100,000-member Michigan United Conservation Clubs (MUCC) to bypass the legislation and to go directly to the people via a referendum. The 1974 MUCC annual convention passed a floor resolution that called for direct citizen action if the legislature again failed to act.

Although both the MUCC and Jondahl were hesitant about a referendum, when Jondahl's bill appeared stalled in the House Appropriations Committee, MUCC's director and Jondahl decided to proceed publicly.

Governor William Milliken was the first person to sign the bottle bill petition. Michi-

gan needed the bill, he said, and a 1975 Market Opinion Research Poll commissioned by his office showed that seventy-three percent of Michigan voters wanted it. With that publicity and their extensive state-wide organization, MUCC produced 400,000 petition signatures by June 4th, nearly double the number required to qualify for the November 2nd ballot. Industry and labor leaders immediately filed suit to block the referendum, claiming that the petition drive was unconstitutional and that the petitions themselves were technically incorrect and had been filed too late to appear on the November ballot. That suit was rejected by both the Circuit Court and the Michigan Court of Appeals.

It is more accurate to refer to the legislation as a Minimum Deposit Initiative or, once it was on the ballot, as a Minimum Deposit Proposal. The proposed legislation did not ban any type of container, but it did mandate a deposit be paid when purchasing beer or soft drinks in containers up to one gallon in size. Since this paper focuses upon the public debate, we will use the terms commonly employed during the campaign rather than the more legally precise phrase.

A longer version of this paper, available from the authors, contains a detailed history of the campaign based on extensive newspaper files and a series of interviews with key figures.

2. For a discussion of "technological style" and other central concepts, see Part II of this paper. An anthology of papers delivered at one of the early national conferences dealing with the environment was given the title: *No Deposit—No Return: Man and His Environment: A View Toward Survival* (13th National Conference [1969] of the U.S. Commission for UNESCO, Huey D. Johnson, ed., Reading, MA, 1970). The symbolic significance of the phrase "No Deposit—No Return" is emphasized by the fact that, although the phrase originated in beverage industry advertising, none of the papers included in the anthology dealt with the container issue.
3. The most spirited defense of non-returnable containers was given by William F. May, Chairman of the Board of the American Can Company, in testimony before a U.S. Senate subcommittee. May linked single-use containers and the technological style they repre-

sented to the solution of the world food problem, maintaining the American standard of living, solving energy and waste disposal problems, and the engineering practices that have made America great. The following quotation suggests the flavor of May's presentation: "This Nation has reached preeminence by its genius in productivity doing more [with] less. We oppose the sad prospect that we should now produce less for more, at greater and unnecessary costs in capital, consumer prices and energy." Earlier in the same hearings, Senator Mark O. Hatfield presented a view from the opposite side. According to Hatfield "throwaway containers should be repugnant reminders of how little society cares about wanton depletion of its energy resources. . . . A laundry list of areas exists where blind obedience to technology has created a host of problems. The beverage container area provides the chance to reject this throwaway ethic spawned by the idolatry of technology, and also the demand for convenience and disposables on the part of the consumer." (U.S. Senate, Committee on Commerce, Subcommittee on the Environment, *The Non-returnable Beverage Container Prohibition Act*, Hearings on Senate Bill 2062, 93rd Congress, 1st Session, 1974, pp. 196, 40.)

4. The Michigan campaign was fought in the political and statistical context generated by a few previous campaigns, the most important of which was in Oregon. The most careful discussion of the Oregon litter surveys may be found in Don Waggoner, *Oregon's Bottle Bill: Two Years Later* (Columbia Group Press, 1974). Waggoner, an active supporter of bottle legislation, argues convincingly that the Oregon data shows a substantial decrease in litter.

The major conflicting studies of the impact of the Oregon legislation are Applied Decision Systems, *Study of the Effectiveness and Impact of the Oregon Minimum Deposit Law*, Project Completion Report (Wellesley Hills, MA, October 1974); and Charles Gudger and Jack Bailes, *The Economic Impact of Oregon's "Bottle Bill"* (Corvallis, OR, 1974). The differences are briefly outlined in Waggoner, *op. cit.*, pp. 32-33. Two important studies prepared for the Environmental Protection Agency are Tayler H. Bingham and Paul F. Milligan, *The Beverage Container Problem: Analysis and Recommendations* (Research

- Triangle Institute, 1972); Environmental Protection Agency, *Environmental Analysis of Nine Beverage Container Alternatives* (Washington, DC: U.S. Government Printing Office, 1974). An important industry study is "Resource/Energy Recovery and Recycling vs. Source Reduction: A Simple Economic Analysis of Two Basic Resource Conservation Strategies," prepared by R. S. Weinberg and Associates for the United States Brewers Association, Inc. The Weinberg study is available in *Reference Source Book* (Washington, DC: United States Brewers Association, Inc., n.d.). During the last part of the legislative phase and during the election campaign, a Michigan Public Service Commission study by Gondy Rao (*Economic Analysis of Energy and Employment Effects of Deposit Regulation on Nonreturnable Beverage Containers in Michigan*, October 1975) was used extensively.
5. The Applied Decision Systems Study (*Study of the Effectiveness and Impact of the Oregon Minimum Deposit Law*, Project Completion Report, Wellesley Hills, MA, October, 1974) mandated by the original Oregon legislation prohibiting disposable containers was repudiated by Oregon State officials including governors McCall and Straub. A Michigan study commissioned by industry and undertaken by Susan Rideout and Ramon Reyes, *A Study of the Impacts of Proposed Beverage Container Legislation in Michigan* (Ann Arbor, MI: University of Michigan Graduate School of Business Administration, May 1976) was never released because industry disapproved the assumptions made about the number of times a returnable bottle would be used before being discarded.
 6. Don McClenahan, director of waste disposal for Monsanto, cited in Tom Alexander, "The Packaging Problem Is A Can of Worms," 85 *Fortune* 6 (June 1972): 105-107 ff.
 7. This theme was used effectively by Thomas Kimball, Executive Vice-President of the National Wildlife Federation, in testimony given at 1974 U.S. Senate hearings. According to Kimball, "The energy wasted in the United States just on beer and soda containers exceeds the combined energy requirements of [15] countries in Africa, Asia, and Central America. The total population of those countries amounts to over 185 million people. It is in this context that the matter of beverage container waste should be considered. The ways we are using the world's resources will be subject increasingly to critical scrutiny by developing countries as well as succeeding generations to our own country—and rightly so. . . . It is no longer viable to squander our nation's energy resources in the production of one-time use containers supplying leisure beverages to the consumer." (*op. cit.*, Note 3, p. 164.)
 8. Following World War II, a combination of non-returnable containers, new packaging and marketing techniques and aggressive advertising enhanced the competitive advantage of the few large national breweries over the numerous local and regional producers. As recently as 1947 there were over 400 firms in the industry; but by the 1970's the transformation of the industry was almost complete. Dominated by a few large firms, its production workers were among the most highly paid in American industry and its new "super" breweries which require from \$125,000 to \$150,000 of fixed assets per production worker, gave it a high place among America's most capital-intensive industries. Critics have charged that many thousands of jobs were lost during the process of centralization. That and the throwaway's wastefulness led to charges that the capital-intensive, centralized technological style of the major brewers is both socially and environmentally irresponsible.
 9. Interview with Lester Freidinger, Chairman CAFD, Detroit, 21 September 1977, and confirmed in Environmental Protection Agency, *op. cit.* (Note 4).
 10. *New York Times* wire service story, *The Jackson Citizen Patriot*, (17 October 1976).
 11. Senator Mark Hatfield, *op. cit.* (Note 3).
 12. For instance, an ad in *The Manistee News Advocate* (29 September 1976).
 13. "At Issue: The Beverage Container," (pamphlet), Kaiser Aluminum and Chemical Corporation (February 1976), p. 14.
 14. *The Detroit News* (28 September 1976).
 15. Environmental Protection Agency, Office of Solid Waste Management, *Third Report to Congress* (Washington, DC: U.S. Government Printing Office, 1974).
 16. For example, the municipal recycling system developed by William F. May's American Can Company was named "Americology."

17. The final spending totals were: CAFD, \$1,316,939 and MUCC's Help Abolish Throwaways Committee (HAT), \$117,175. (*Detroit Free Press*, 22 December 1976.)
18. Individuals such as Jondahl (see Note 1) who were deeply involved during that legislative phase of the campaign knew the major studies but others who became active during the public phase did not seem to have a similar competence. In fact, for each side it was more important to have an expert supporting their cause than it was to know in detail what the expert said. This phenomenon is consistent with observations reported by Dorothy Nelkin, "The Political Impact of Technical Expertise," 5 *Social Studies of Science* (1975): 35-54.
19. Conversation with former state legislator William Ballenger, 16 October 1977. Ballenger had introduced a bottle bill in the late 1960's. It met the same fate as did those of Slingerland and Jondahl.
20. Many supporters of the referendum would reject the suggestion that the U.S. economy was the appropriate context to consider. See Note 7 for a forceful statement of this position.
21. McCall came to Michigan twice during the fall, once to campaign for MUCC and once to speak at Michigan State University. He called the bottle bill "the most strongly symbolic issue we have. . . . It serves as a bridge from the wasteful society to a husbanding society. . . . It is one ripple in a major wave of reuse, recycling and conservation" (*The Detroit Free Press*, 22 September 1976). Senator Hatfield spoke at Albion College during the campaign (*The Lansing State Journal*, 24 October 1976). And MUCC brought an Oregon environmentalist, a food store chain owner, and a housewife to Michigan to testify (*The Lansing State Journal*, UPI wire story, 21 October 1976).
22. William Sadd, "Industry and Labor Perspectives: Innovation Versus Regulation," in Environmental Protection Agency, *Proceedings: 1975 Conference on Waste Reduction* (Washington, DC: U.S. Government Printing Office, 1975).
23. For a thorough study of the convergence in the late 1960's of various streams of thought to form the recent environmental movement, see Donald Fleming, "Roots of the New Conservation Movement," 6 *Perspectives in American History* (1972): 7-91. For a good discussion of the intellectual history of aspects of radical humanism see Richard King, *The Party of Eros* (New York: Delta Paperbacks/Dell, 1972). Michael S. Baram provides an excellent discussion of the development of the consumer and the environmental movements in the 1960's and early 1970's; see his "Technology Assessment and Social Control," 180 *Science* (4 May 1973): 465-473.
24. "Cultural myth" is an important concept in our theoretical approach (see Part II of this paper).
25. Clifton Fadiman, "A Technologized Culture," 10 *Center Magazine* 2 (March/April 1977): 71-78.
26. Theodore Roszak, *Where the Wasteland Ends* (New York: Doubleday, 1972); David Dickson, *The Politics of Alternate Technology* (New York: Universe Books, 1974); Elting E. Morison, *From Know-How to Nowhere* (New York: Basic Books, 1974).
27. The original proposal language provided that the legislation would go into effect two years after the election results were certified by the Michigan Secretary of State. The two-year delay was to allow an orderly transition to the new system.
28. For example, a student leader of the Michigan State University PIRGIM (Public Interest Research Group in Michigan) chapter made the following comment about the CAFD: "They failed to understand the difference between appropriate and inappropriate technologies. We feel that appropriate technologies are ones that do not tend to harm people or the environment. We are all for the progress and development of appropriate technologies" (private communication to the authors, Winter 1977). The best known and most effective presentation of the "appropriate technology" position is found in F.F. Schumacher, *Small Is Beautiful* (New York: Perennial/Harper and Row, 1976).
29. For an interesting discussion of this topic, see Steven Cotgrove, "Environmentalism and Utopia," 24 *Sociological Review* n.s. 1 (February 1976): 23-42.
30. For a discussion of the interaction between technical change and perspectives such as the "creed of progress" see David E. Wright, "Promethean Legacy: Ambivalent Relations Between Man and His Tools," 5 *The American Examiner* 3 (Spring 1978): 1-25.

31. The concept of cultural myth as it is now used in American Studies was developed by Henry Nash Smith in *Virgin Land: The American West As Symbol and Myth* (New York: Vintage, 1950). An excellent brief summary of the way Smith and other major scholars have used this construct may be found in Cecil F. Tate's *The Search For Method in American Studies* (Minneapolis: University of Minnesota Press, 1973). One thoughtful critique of this method is Bruce Kuklick's "Myth and Symbol in American Studies," 24 *American Quarterly* 4 (Fall 1972). John Cawelti responds to that critique in "Myth, Symbol and Formula" 8 *Journal of Popular Culture* 1 (Summer 1974).
 32. For a more extensive discussion of this concept, see Robert E. Snow and David E. Wright, "The Battle of Technological Styles in America: A Brief History and Analysis," *Journal of American Culture* (Winter 1980), forthcoming.
 33. See, for example, Leslie White's *The Science of Culture* (New York: Farrar Straus and Cudahy, 1949), p. 366, which is also cited and discussed in Langdon Winner's *Autonomous Technology* (Cambridge, MA: The MIT Press 1977), p. 76, for a similar three-level model. White's model, however, is used to argue for a very different causal mechanism of cultural change, one which is essentially based on technological determinism.
 34. For an extended example of the way in which the symbolic level functions see David E. Wright and Robert E. Snow, "Las Vegas: Metaphysics in the Technological Society," 23 *The Centennial Review* 1 (Winter 1979): 40-61.
 35. Much of our approach to popular culture depends on the seminal theoretical work done by Russell B. Nye, Ray B. Browne, and John Cawelti. For a good introduction to this field see the special section in 9 *The Journal of Popular Culture* 2 (Fall 1975), titled "Theories and Methodologies in Popular Culture."
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Scientific Freedom and Responsibility Activities of Scientific Societies¹

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In 1975 the American Association for the Advancement of Science (AAAS) Committee on Scientific Freedom and Responsibility issued a report urging scientific societies to assume a variety of roles directed toward the protection of scientific freedom and the practice of scientific responsibility.² In addition to specific recommendations to the AAAS, the committee called on other societies to form boards or committees to investigate breaches of scientific freedom and to aid individuals who in the practice of their responsibilities expose themselves to economic and/or professional censure (e.g., "whistle blowers"). In addition, the committee urged scientific societies to disseminate scientific information in areas where science impinges on social issues, and supported the use of codes of ethics and employment/arbitration guidelines to protect "whistle blowers" and thus indirectly promote their efforts.

During the last few years, a number of articles have suggested that scientific societies are becoming more active in what has been variously described as public-interest science or scientific responsibility. These articles were based on observations of small numbers of societies, reports of personal experiences, and subjective evaluations³, but did not provide quantitative data on the extent of such involvement by scientific societies. Therefore, in the survey reported in this article, I attempted to determine (1) the extent of scientific societies' activities related to issues of scientific freedom and responsibility, (2) the characteristics of societies associated with such activities, and (3) the societies' responses to the AAAS report.

In order to evaluate the extent of the scientific societies' commitment to support of scientific freedom and responsibility, certain practices had to be identified as indicators of such support.

However, the controversy surrounding current discussion of the boundaries of scientific freedom and the focus of scientific responsibility makes this task difficult.⁴ Jeremy Stone, for example, has described two kinds of responsibility. The first he calls the responsible conduct of scientists, a responsibility to the scientific community.⁵ This is the traditionalists' view of scientific responsibility, one which is protective of science, considers it vaguely or flatly irresponsible to make imprecise public assertions, and questions the advocacy of policy decisions that go beyond science.⁶ The other, broader interpretation accepts the fact that all public policy decisions involving science go beyond science and that scientists' responsibility to society is to enter the debate on such decisions "in a civilized fashion."⁷ Supporters of the narrower view hold that a scientist who speaks beyond the scientific data in a public forum should be censured, while those who espouse the second urge censure of scientists who do *not* speak to evidence, albeit incomplete, of where scientific or technical activities present a public hazard.

The AAAS Committee did not distinguish between the two kinds of responsibility. It stressed that "one of the basic responsibilities of scientists is to maintain the quality and integrity of the work of the scientific community,"⁸ and yet also discussed the need for social responsibility.⁹ In my study, society representatives were asked about procedures and activities that could support either kind of responsibility, including such activities as responses to member requests for aid on issues of scientific freedom and responsibility, codes of ethics, employment guidelines, public interest activities, and political action.

A number of descriptive variables indicative of size, location, and professional activities were

used to characterize the scientific societies. The nature of members' employment as well as their disciplines and places of employment were also included. It has been suggested that the difference between professional societies (those dedicated to advancement of knowledge) is disappearing and that professionalization is growing in all societies;¹⁰ nevertheless, differences regarding degree of professionalization do exist, as do differences in values among different types of scientists.¹¹ In this study, I assumed that differences in members' disciplines, occupations and places of employment are reflected in their values and may be associated with their societies' activities on scientific freedom and responsibility issues. Thus, categorization based on disciplines, occupation and places of employment were made.

Description of Survey

Using a composite list of 451 U.S. scientific and technical societies either affiliated with the AAAS or listed in a National Academy of Sciences publication,¹² I selected a probability sample of 216 societies. The final research sample consisted of 133 societies, a 62% response of useable questionnaires. It is impossible to state with any degree of certainty that the research sample was representative of scientific societies since no listing of all such societies exists, and there is no agreement as to which societies should be included under the description of scientific and technical. However, the sample did include a large number and a wide variety of societies, as described below, and represented 29.2% of *all* societies identified as scientific or technical by the AAAS and NAS lists.¹³

Characteristics of Responding Societies

In most instances, the questionnaires were addressed to and returned by the executive officers of the societies, although in some instances, presi-

TABLE 1
Characteristics of Responding Societies

Membership Size (N=132)	
100-800	21%
900-3,400	29
3,500-8,000	26
8,500-40,000	20
55,000-170,000	5
	100%
Staff Size (N=130)	
None	27%
1-3	25
4-13	22
15-105	21
115-950	5
	100%
Discipline (N=133)	
Physical	17%
Biological	16
Medical	24
Agricultural & Industrial	23
Social & Educational	15
General	6
	100%

dents, vice presidents or elected secretaries responded. As summarized in Table 1, membership size of the responding societies ranged from 100 to 170,000; the median was 3,350 members. Staff support, another indicator of size, ranged from none (that is, all work was done by volunteers) to 950. The median number of staff members was three, and it should be noted that 27% of the societies had no staff support at all. All disciplines were represented. Organizations classified as general (e.g., fraternities and societies such as Graduate Women in Science) were omitted from some of the analyses.

Approximately 30% of the societies that responded to the questionnaire were composed almost exclusively of individuals pursuing one type of occupation, such as teaching or research or providing services, but most had mixed memberships. Forty-one percent reported "teaching" as the occupation of a plurality of their members. Employment in an academic institution by a plurality of the members was reported by 50% of the societies, and in industrial settings by 20% of the societies; the remainder reported most of their members as self-employed, working in community or non-profit institutions, or in government agencies. Headquarters of 38% of the sample societies with permanent officers were located in Washington, DC; 30%, in other eastern cities. Fifty-four percent of the responding societies were affiliates of the AAAS.

Activities Related to Scientific Freedom and Responsibility Requests For Aid

Respondents were asked about the number of requests for help on issues of scientific freedom and responsibility they had received since 1968.¹⁴ Sixteen percent of those who responded reported between one and forty such requests, for a total of 120 cases. Examples given were the harassment of foreign scientists, equal rights for women scientists, the creationist controversy, academic freedom, interference with publications and travel, and pressure to perform acts inimical to public safety. Only seven of the twenty societies had boards or committees to investigate such problems¹⁵ and only five, one with no board, reported intervening in such cases. Thus, it appears that although conflicts involving scientific freedom and responsibility do exist, the societies express little interest or involvement. Furthermore, since scientific societies have not involved themselves in such issues in the past, the number of appeals may not reflect the actual number or extent of such conflicts.

TABLE 2
Codes of Ethics and Scientific Societies

Existence of Codes (N=128):		
Adopted	14%	(53)
Not adopted	55%	(70)
Being considered	4%	(5)
	100%	

Date of Adoption of Codes (N=58):		
Prior to 1968	28%	(16)
After 1968 or being considered	62%	(36)
No date given	10%	(6)
	100%	

Existence of Codes According to Type of Society:		
	Percent having codes	
Disciplinary Affiliation		
Physical sciences (N=22)	23%	(5) ^a
Biological sciences (N=21)	19%	(4)
Applied sciences ^b (N=58)	62%	(36)
Social Sciences (N=19)	37%	(7)
Occupation of Plurality of Members		
Teaching (N=43)	21%	(9) ^c
Non-teaching (N=61)	57%	(35)
Employment of Plurality of Members		
Academe (N=59)	22%	(13) ^d
Industry (N=23)	52%	(12)
Miscellaneous ^e (N=36)	69%	(25)

^a The difference of codes between the different disciplines was significant below 0.001; chi square=17.5, df=3.

^b Agricultural, engineering and medical sciences.

^c The difference in codes between the occupations was significant below 0.01; chi square=10.4, df=1.

^d The difference in codes between employment places was significant below 0.001; chi square=20.2, df=2.

^e Government, nonprofit institutions, and self-employed.

Codes of Ethics and Employment Guidelines

The AAAS report suggested that codes of ethics and employment guidelines could be useful procedural approaches to the resolution of conflict and promotion of responsibility.¹⁶ Although such codes of ethics are frequently designed to protect the profession rather than the public welfare, and employment guidelines are model contracts spelling out conditions of employment and are aimed at protecting the scientist-worker from arbitrary dismissal on any grounds, both could be adapted to or used to protect the whistle blower and foster the exercise of social responsibility.¹⁷ Table 2 presents information regarding codes of ethics. Almost half of the societies already have codes or are considering them. A majority of these codes were adopted after 1968.

Employment guidelines exist in a few societies (Table 3) but arbitration guidelines, which would make the former enforceable, are extremely rare. Only three societies reported arbitration guidelines. An analysis of the types of societies with codes and guidelines is presented later.

Characteristics of Societies Active on Scientific Freedom and Responsibility Issues

When the societies active in areas related to scientific freedom and responsibility issues were compared to those which were not, certain differences were noted. More societies (25%) whose memberships were primarily employed in academic institutions reported requests for aid in the resolution of scientific freedom and responsibility conflicts than societies that represented pluralities of members not academically employed (9%). [This was statistically significant below the 0.05 level as calculated by chi square.] Twenty-eight percent of all societies representing primarily members who teach received such requests, as compared to 13% of all others. The twenty societies receiving such requests represented social, physical, biological and medical scientists; societies for the agricultural and engineering sciences reported no cases.

More applied science societies than physical and biological science societies reported that they had codes of ethics (Table 2). Societies that reported teaching as the most common occupation of their

TABLE 3
Employment Guidelines of Scientific Societies

Existence of guidelines (N=124)		
Exist	15%	(18)
Do Not Exist	85%	(106)

Existence of Guidelines According to Members' Orientation:			
Disciplinary Affiliation	Percent Having Guidelines	Employment of Plurality of Members	Percent Having Guidelines
Physical Sciences (N=20)	10% (2)	Academe (N=56)	9% (5)
Biological Sciences (N=20)	5 (1)	Industry (N=24)	17 (4)
Applied Sciences ^a (N=57)	23 (13)	Miscellaneous ^b (N=33)	24 (8)
Social Sciences (N=20)	10 (2)		

^a Agricultural, engineering and medical sciences.

^b Government, non-profit institutions and self-employed.

members were less likely to have codes of ethics than societies whose members were otherwise employed. Similar results were obtained for the societies with most members employed by academic institutions, compared to those with memberships primarily in private industry, government, nonprofit institutions or self-employment. This difference reflects the traditional orientation of client-oriented versus knowledge-oriented scientists; the recent increase in the promulgation of codes does not appear to have occurred among the latter group.

A similar situation exists in regard to employment guidelines, which were more frequently used by the applied science societies (e.g., associations of engineers or medical professionals). Only two of the societies with guidelines were com-

TABLE 4
Public Interest Activities of
Scientific Societies^a

Activity Types:			
Publications (N=125)		Year of First Publication	
Yes	18% (23)	Prior to 1968	44% (10)
No	82% (102)	After 1968	35% (8)
		No Date Given	22% (5)
Forums (N=121)		Year of Initial Forum (N=34)	
Yes	28% (34)	Prior to 1968	41% (14)
No	72% (87)	After 1968	41% (14)
		No Date Given	18% (6)

Existence of Public Interest Activities According to Type of Society:		
Occupation of Plurality of Members	Percent Issuing Publications	Percent Sponsoring Forums
Teaching	29%	38%
Nonteaching	13%	27%
Employment of Plurality of Members	Percent Issuing Publications	Percent Sponsoring Forums
Academe	28%	40% ^b
Industry	9%	14%
Other	14%	23%

^aThe N varies among categories because not every society answered each question.

^bDifference is significant under 0.5; chi square=6.21, df=2.

TABLE 5
Political Activities of Scientific
Societies (N=129)^a

Type of Activity	Percent of Respondents Who Had Activity	
Public Affairs Committee	45%	
Advisors to Government	46%	
Communication to Legislators	33%	

Societies Having Public Affairs Committees:		
According to Occupation of Plurality of Members:		
Teaching (N=45)	38%	(17)
Nonteaching (N=60)	53%	(32)
According to Employment of Plurality of Members:		
Academe (N=60)	38%	(23) ^b
Industry (N=23)	39%	(9)
Self-employed (N=17)	53%	(9)
Government, non-profit (N=18)	83%	(15)

^a Not all respondents answered each question; therefore there is some variation in N.

^b Difference between types of employment is statistically significant below 0.01; chi square=12.1, df=3.

posed primarily of scientists in nonapplied disciplines. Societies which have employment guidelines tend to engage in many other professional activities, and are most committed to activities designed to enhance the competence, autonomy, and status of their members.¹⁸

Societies composed of academic scientists are more active in public information efforts than those representing scientists in nonacademic occupations, although the differences were statistically significant only in the case of forums (according to places of employment). Nevertheless, societies with large percentages of members in academic occupations or employed in educational institutions were more likely to be involved in public education, as presented in Table 4.

On the other hand, political action is apparently more common among nonacademic societies. Fewer teaching than non-teaching scientists' societies reported having public affairs committees (Table 5), although the difference is not statistically significant. Societies representing scien-

tists employed by the government and by non-profit institutions have the greatest percentage of public affairs committees.

In summary, few societies seem to be committed to scientific freedom and responsibility activities; less than half have any procedures which could be used to promote or support social responsibility. Furthermore, activities compatible with the support of scientific freedom and responsibility tend to be related to the work orientation of the members. Societies representing academically-employed scientists; for example, tend to engage in more public information education activities and are more frequently recipients of requests for aid on scientific freedom and responsibility conflicts, while codes of ethics, employment guidelines and public affairs committees are more common among societies that represent scientists working in industry.

Response to the AAAS Report

The distinctions outlined above may in part explain the meager response of the societies to the AAAS Report.¹⁹ Answers regarding awareness of the 1975 report (have you seen, read, or heard of), and consideration of the report are summarized in Table 6. As can be seen, although 35% of the respondents had heard of the report,²⁰ only 62% had read it and only 42% actually owned a copy.²¹ Furthermore, very few described any consideration of the report. Although 19 of the societies aware of the document reported discussion or communications regarding the report, only five of these publicized it to their memberships and only ten governing boards discussed it. Of these ten, three stated that they chose to cooperate with the AAAS (there is no evidence that one of them did so) and three referred the matter to standing committees.

There is little evidence that scientific societies have any interest in the recommendations. Although 41% (21) of the "aware" respondents found that the report addressed issues pertinent to their societies and 16 respondents found the specific recommendations pertinent, only five individuals could recall any of the recommendations of the report.²² In addition, there is no evidence of any interest in whistle blowers. Only eight respon-

dents said they believed legal guidelines for the protection of whistle blowers would benefit their members; most chose not to answer. One hundred and four believed their society had no desire to establish a board of inquiry for issues related to scientific freedom and responsibility.

There was a difference between the societies whose leaders were aware of the report and those whose leaders were not. Leaders whose societies published materials and held forums for the public, had received requests for aid by members, and whose members were primarily employed in academe were more likely to be aware of the report. There was also an association between AAAS affiliation, contact with AAAS committee members, and proximity to Washington, DC, and awareness.

Nine societies, all of which had greater resources (headquarters, membership size, staff) than the average society, were characterized as being most responsive to the report on the basis of cooperation with the AAAS and serious consideration of the report by a board or committee. All but one of these societies reported requests from members for help on issues of scientific freedom and responsibility; most reported two to five such requests, and two reported twenty-five and forty each. Only five of these societies responded to such requests. A plurality of the members of all nine societies are employed in academic institutions and their primary functions are teaching. Five of them reported forums for the public and

TABLE 6
Response to AAAS Report
by Scientific Societies

Societies That Were Aware of the Report	35%	(47)
Societies That Were Not Aware of the Report	65%	(86)
Nature of Awareness (N=47)		
Read the Report	62%	
Own a Copy	42%	
Identified Source of Awareness ^a	62%	
^a A few respondents named several sources; 16 identified the sources as a copy of the report, 11 named the articles in <i>Science</i> magazine, and six named another individual.		

four, publications for the public. Finally, the responding leaders of these societies appear to have a wide range of contacts with a number of individuals in the AAAS who are either members of the Committee on Scientific Freedom and Responsibility, or are involved in its work.

Discussion

What appears to be a lack of interest in the recommendations of the AAAS committee and its report could be due to a variety of factors—the controversial nature of the issues, the historical avoidance of political issues by scientific societies, or the societies' insufficient resources. It could also be due to a lack of compatibility with either the report's ideology or recommended procedures.

According to the Rogers and Shoemaker paradigm of the collective innovation decision-making process, legitimation or approval of a new idea is generally a function of the power-holders or leaders of a social system, and the adoption of innovations depends on, among other factors, the compatibility between the innovation and the values, past experiences and member needs of the adoption organization.²³ The organizations addressed by the AAAS committee's recommendations are extremely diverse, with different values and member needs. Some of the procedures recommended, such as codes of ethics and employment guidelines, are compatible with one type of organization (the client-oriented or professional organization), while the issues themselves, the ideological components of the report, are more compatible with those of another type of organization (the knowledge-oriented or scientific). Although instrumentally, professional activities appear related to the report's recommendations, societies more interested in professional autonomy and status may not view the ideology of the AAAS as relevant to their interests²⁴ and thus may not perceive the report as compatible with their values. On the other hand, societies which have been active in public interest science may find the social responsibility emphasis of the report compatible with their objectives, but the procedural recommendations (board of inquiry, codes of ethics, etc.) incompatible. Support of whistle blowers does not appear to be compatible with the

interests of the societies.

However, there may also be a deeper, attitudinal incompatibility between the AAAS report and the scientific societies. On the one hand, the report questions the uncontrolled pursuit of science and the unconcerned practice of technology. It suggests that scientists themselves evaluate, monitor and censure certain conducts in science, and that in some instances restraints may be necessary. The societies, on the other hand, are committed to the promotion of science and scientists.²⁵ Although the actions of scientists on the recombinant DNA issue are frequently cited as an example of social responsibility, one of the major concerns of scientific societies on the issue became the assurance of autonomous regulation of DNA research by scientists themselves and not by nonscientists.²⁶

In conclusion, it should be noted that although the AAAS report did not initiate any major changes in scientific societies, it was a document that identified new developments and needs in the scientific social system. The impact of the report undoubtedly was diminished by a lack of effective communication between the AAAS and its affiliates. However, the successors to the 1970-75 committee are developing an active communications network and a working relationship with a number of societies, neither of which efforts existed at the time the report was published.²⁷ This arrangement may help to identify compatibility of interest, thus contributing to successful communication, and possibly initiating change. Further identification of differences in the needs and value systems of different scientists is also necessary. That such differences are profound is apparent in, for example, the conflict among ecologists over codes of ethics, or among entomologists over affiliation with the Council for Agricultural Science.²⁸ With few exceptions, sociological studies have focused on basic, academic scientists, but such work may not be applicable to the much larger number of applied scientists whose involvement in conflicts of social responsibility can have immediate and great importance to society.

NOTES

1. This work was part of a dissertation requirement for a Ph.D. degree in the School of Edu-

- cation, Health, Nursing and Arts Professions, New York University, under the supervision of Professors F. James Rutherford, Joseph Giacquinta and Henry J. Perkinson.
2. American Association for the Advancement of Science, *Scientific Freedom and Responsibility*, AAAS ad hoc committee report prepared by John T. Edsall, (Washington, DC: AAAS, 1975). The report was mailed to the presidents of societies affiliated with the AAAS as well as approximately fifty other leading scientists. It was also summarized in John T. Edsall, "Scientific Freedom and Responsibility," 188 *Science* (16 May 1975): 687-693.
 3. Examples of these are as follows: Joel Primack and Frank von Hippel, *Advice and Dissent, Scientists in the Political Arena* (New York: Basic Books Inc., 1974); Doris K. Miller, "Scientific Societies and Public Responsibilities," 196 *Annals of the New York Academy of Sciences* (7 June 1972): 21-31, and William A. Blanpied, "The Ethical and Human Value Implications of Science and Technology: Subjective Impression Regarding Contemporary Concern and Trends," 1 *Newsletter of the Program on Public Conceptions of Science* 8 (June 1974): 136-156.
 4. Haberer states that scientists are unable "to define, delineate or even recognize the nature of the problem of responsibility." Joseph Haberer, *Politics and the Community of Science* (New York: Van Nostrand Reinhold Company, 1969), p. 311. Since then discussions have continued on this issue.
 5. Jeremy J. Stone, "To Whom Are Public Interest Scientists Responsible?" *Federation of American Scientists, Public Interest Report* 29 (December 1976).
 6. This attitude was cogently expressed by Joseph Ben-David, "On the Traditional Morality of Science," 1 *Newsletter of the Program on Public Conceptions of Science* 13 (October 1975): 24-35.
 7. Stone, *op. cit.* (Note 5), pp. 1, 2.
 8. AAAS, *op. cit.* (Note 2), p. 8.
 9. In 1978 the second AAAS Committee on Scientific Freedom and Responsibility prepared a revised charter and recognized the "dual aspects of scientific responsibility, commonly referred to as 'professional' and 'social' . . ." AAAS, *Committee on Scientific Freedom and Responsibility, 1978 Annual Report* (Washington, DC: AAAS, 1976), p. 6.
 10. Professional societies have been described as being organized primarily for prestige, study, qualifying and occupational benefits, while scientific societies exist for the goal of furthering science. Blume argues that attempts to identify a society as primarily devoted to professional-protective pursuits or to ideological-intellectual ones is futile, since social and economic constraints are imposing great changes in both. Stuart S. Blume, *Toward a Political Sociology of Science* (New York: The Free Press, 1974), pp. 118-122. Rich describes all societal functions as related to the support of professional autonomy and status, and designed to foster "private government." He concluded that none of the societies differ in their objectives in any substantial manner. Daniel Rich, "Private Government and Professional Science," in Albert H. Teich, ed., *Scientists and Public Affairs* (Cambridge, MA: The M.I.T. Press, 1974), pp. 3-37.
 11. Using interviews and mail questionnaires of several hundred students and scientists, Cotgrove and Box set up a typology of scientists according to their attitudes toward the norms of science as identified by Merton [Robert K. Merton, "The Normative Structure of Science," in R.K. Merton, ed., *The Sociology of Science* (Chicago: The University of Chicago Press, 1973), pp. 268-278.] Adherence to these norms varied depending on whether a scientists' allegiance is first and foremost to science and they attach major importance to the sharing of knowledge (communism). To these scientists the other norms follow from this commitment. Private scientists, most of those working in industry, attach importance to disinterestedness and organized skepticism but not to the sharing of their work with the whole scientific community. Organizational scientists, also found in industry, see scientific research as a comfortable living, and are the least committed to any of the norms of science. Stephen Cotgrove and Steven Box, *Science, Industry and Society* (New York: Barnes and Noble, Inc., 1970).
 12. The last edition of this compilation was published in 1971. National Academy of Sciences, *Scientific, Technical and Related Societies of the United States*, 9th ed. (Washington, DC: National Academy of Sciences, 1971). Certain

associations, such as state academies and societies, umbrella groups and societies composed predominantly of laymen were eliminated.

13. There was no statistically significant difference between the respondents and the non-respondents according to discipline, or location of permanent offices and AAAS affiliation; a larger percentage of the societies with permanent offices and AAAS affiliation responded. (Chi square was 6.7 and 4.6, respectively, with one degree of freedom.) Although there was some bias in the response, it was not of a major proportion.
14. This date was chosen because it was a year of great ferment within the scientific community as expressed in the rise of public interest groups and agitation at scientific meetings.
15. Some of these may not be special boards set up for such a purpose, but ethics committees or governing boards.
16. The codes of ethics issue has divided the scientific community for many years. An example of such a controversy within the ecological society was presented by Dorothy Nelkin, "Scientists and Professional Responsibility: The Experience of American Ecologists," 7 *Social Studies of Science* (February 1977): 75-95. A study of the records of the AAAS revealed a history of attempts to deal with the issue, but no action. The Board of Directors chose not to make this issue a major task of the second Committee on Scientific Freedom and Responsibility; however, at present, the committee is considering the study of codes of ethics of scientific societies. The records of two other societies showed they had settled the conflict by applying their codes only to certain sub-groups within the society. (A more detailed description of the controversies within the AAAS and the two societies can be found in Muzza Eaton, "The Response of Scientific Societies to the Report on Scientific Freedom and Responsibility of the American Association for the Advancement of Science," Unpublished Dissertation, New York University, 1979).
17. The AAAS report discussed ethics codes in terms of social responsibilities rather than in terms of client-oriented issues. However, Blanpied found there was a lack of social responsibility orientation in most of the eighty codes he surveyed. Reynolds found that responsibility to subjects and the public is included in the codes adopted recently by social science societies. William A. Blanpied, "Codes of Ethics of Professional Scientific Societies," 1 *Newsletter on Science, Technology and Human Values* 15 (April 1976): 3-5; and Paul Davidson Reynold, "Values Dilemmas in the Professional Conduct of Social Science," XXVII *International Social Science Journal* (1975): 563-611.
18. The survey collected information on certification programs, accreditation programs, employment services, continuing education programs and various lobbying activities as well as on codes of ethics. All these were performed more often by societies of applied scientists.
19. Since the publication of the report in 1975, the AAAS has established a new committee on scientific freedom and responsibility which has been working with a number of societies on several issues. Their most intensive and successful efforts have been on the issue of the rights of foreign scientists. See AAAS, 1978 Annual Report *op. cit.* (Note 9).
20. It is recognized that the response reflects knowledge by one leader of a society. However, had the recipient of the report believed it to have any value to the society, it can be assumed that he would have communicated this to other leaders, among them our respondents.
21. When the report was published it was mailed to all presidents of AAAS affiliated societies. Only 54% (72) of the respondents of this study were affiliates. The others only had the opportunity of reading the report in *Science*. Forty-seven percent (34) of the affiliates were aware of the report and 21% (13) of non-affiliated societies were.
22. Most of these noted the role recommended for societies, that is, the defense of scientists.
23. Everett M. Rogers and Floyd F. Shoemaker, *Communication of Innovations*, second edition. (New York: The Free Press, 1971), pp. 275-281.
24. The executive officer of the AAAS noted a lack of communication between the AAAS and applied science affiliates. William Carey, "1976 Report to the Association," 196 *Science* (15 April 1977): 337.
25. The overriding attitude apparent in the three societies mentioned previously is the protec-

- tion of the rights of scientists to pursue science as they see fit [Eaton, *op. cit.* (Note 16)].
26. "ASM Adopts Resolution on Recombinant DNA," 43 *American Society for Microbiology News* (July 1977): 345.
 27. Most of the information on the second AAAS Committee on Scientific Freedom and Responsibility was contributed by Rosemary Chalk, Staff Officer for the committee.
 28. The conflict among ecologists was described by Nelkin, *op. cit.* (Note 16). The debate

within the American Entomological Society was reported by John Walsh, "Entomological Society of America: A Vote which Raises Advocacy Issue," 193 *Science* (21 August 1976): 658-660. Two other conflicts reflecting differences in values between basic, academic scientists and applied scientists were apparent in the sharp disagreements over certification, codes of ethics and public policy described in Eaton, *op. cit.* (Note 16).

Instructions to Contributors

Science, Technology, & Human Values is an interdisciplinary quarterly review of scholarly research on and critical analysis of the interaction of science, technology, and their social context. The journal's contents emphasize:

(1) The effects of science and technology on human beings and human society, especially as those effects relate to social conditions and questions of ethics and values;

(2) Communication between the scientific and technical communities and the public, via the mass media, education, or other means;

(3) Public assessment of and attitudes toward science and technology, including public images, legislative action, and citizen participation in assessment of regulation; and

(4) The effects of social values, knowledge, or events on the conduct of science and technology, especially in regard to policy formation, research regulation, funding priorities, and employment or educational opportunities.

Science, Technology, & Human Values prints the following types of material: articles, research

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All manuscripts should be sent c/o the Editor, *Science, Technology, & Human Values*, Aiken Computation Lab 234, Harvard University, Cambridge, MA 02138.

Literature Review

The Handbook of Futures Research,
edited by Jib Fowles
(Westport, CT: Greenwood Press, 1978).

Reviewed by Miriam F. Kelty/National
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Futures research, dedicated to mid- to long-range exploration of alternatives and their technological, social, and value implications, acknowledges that some of today's problems stem in part from inattention to emerging developments and their unanticipated consequences. The field of futures research gained its impetus in the U.S. toward the end of World War II. At that time, national security concerns prompted the War Department to commission the first major forecast of future technological capabilities and to establish what is now the RAND Corporation, thereby institutionalizing the analysis of policy alternatives. Private industry quickly adopted the methods of long-range forecasting and futures planning as did also a variety of commissions and institutes initiated to specialize in futures research on civil, nonsecurity issues. The proliferation of futures research during the past decade is reflected by an expanding literature of new journals and newsletters, by increased membership in the World Future Society (from 200 in 1967, to over 25,000 in 1979), and by the more than 400 courses on the future offered in American colleges and universities.

The Handbook of Futures Research, a compilation of essays and a sampler of the literature, is designed for those interested in, but uninformed about futures research as well as for futurists who want an overview of current research and thinking in the field. The 800-page *Handbook* methodically covers the growth of futures research, its prob-

lems, procedures, illustrative substantive areas, and future challenges. Like many edited volumes, it is occasionally uneven and redundant. For example, Coates' reprinted chapter on technology assessment and Martino's chapter on technological forecasting provide an introduction to methods that have been described in earlier chapters, although their contributions could serve as a sufficient introduction or overview for some readers. A few of the methods chapters seem too difficult for an introductory audience, yet are not sufficiently detailed for novice researchers who may wish to apply the methods. Part III, "The Procedures of Futures Research," does, however, present commonly-used methods and arranges them from the less to the more quantitative.

In Part IV, some substantive essays provide examples of fields and problems in which futurists have been active. It would have been helpful if these essays had illustrated the techniques described in the methods section or had shown how research applying such methods could generate an array of options for policy makers. The editor's plan to offer an optimistic and a pessimistic outlook for selected problem areas is only partially successful, for the pattern of juxtaposition is not consistently implemented. Neither are the opposing attitudes derived from identified research findings or from common data sources. Throughout Parts III and IV, various studies are described but their findings are not summarized, and their significance is not discussed. For example, the chapter on biomedical futures notes that the guidelines of the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research are a starting point for all further work, and that they specify the procedures and articulate the ethical and legal principles that direct research involving human subjects; yet the procedures and principles are neither stated nor discussed. This failure to inform the reader of research findings, of

policy decisions based on such findings, and of the significance of findings is a serious shortcoming for both of the *Handbook's* intended audiences—the interested newcomer and the experienced futures researcher. Because some studies are cited in the substantive section and others are used as examples in the methods section, the lack of a completely cross-referenced index seriously handicaps the reader who is looking for specific citations. Despite its 800 pages, the *Handbook* is also not complete in its coverage of completed studies or in its listing of futures organizations or literature. For example, books and government reports are omitted from the resources section. On the positive side, several essays include discussion of the cross-impact of multiple factors likely to affect the future, a welcome contrast to the portion of the

literature on science, technology and human values that focuses on narrowly-defined areas. Substantively, a discussion of contemporary problems, not of anticipated problems or alternative solutions, is predominant; however, the *Handbook* does introduce the reader to the need for new models of social growth, an area which currently lags behind technological growth models. The development of methods to assess technology in the context of changing social values hints at the nature and breadth of alternatives that one hopes will emerge from the present and next generation of futures studies. The emerging field of futures research, at most twenty-five years old, is speculative and provocative. The *Handbook* may stimulate readers to evaluate its content and methods and thereby improve its intellectual bases.

Weatherwise Policy:

A Review of Two Reports on Weather Modification and Climate Research

The Management of Weather Resources

(Volume I, *Proposals for a National Policy and Program*; and Volume II, *The Role of Statistics in Weather Resources Management*), Report of the Statistical Task Force to the Weather Modification Advisory Board

(Washington, DC: U.S. Government Printing Office, 1978)

International Perspectives on the Study of Climate and Society, Report of the International Workshop on Climate Issues (Schloss Laxenburg, Austria, April 1978) to the Climate Research Board, Assembly of Mathematical and Physical Sciences, National Research Council

(Washington, DC: National Academy of Sciences, 1978).

Nations may impose legal or physical barriers around their immediate environment, but we all share the weather. What leaves a smokestack in one city may fall in rain over another; what condenses over one nation's lakes may nourish (or wash out) the crops in another. Recent advances in meteorology, particularly in weather modification, as well as sensitivity to the complex of social, economic, political, and ethical aspects of environmental issues, have resulted in the ap-

pointment of national and international advisory groups. The reports of two of these merit special attention.

The Management of Weather Resources: Issues and Policies

In U.S. Public Law 94-490, the National Weather Modification Policy Act of 1976, Congress directed the Secretary of Commerce to survey the scientific knowledge concerning weather modification and the problems impeding implementation of the technology, preparatory to development of national policies and programs on weather modification. The report from the Weather Modification Advisory Board (WMAB) appointed to carry out this mandate demonstrates that the issues at stake are as complex, amorphous, and occasionally as changing as weather itself.¹ For weather modification policy does not involve only initiated acts of technological modification (e.g., cloud seeding) but must now also take account of "unintended weather" caused by cities, power plants, deforestation, and other activities of industrialized society.

Too much rain, snow, wind, heat, or cold can, in one way or another, cause problems for every person on earth. Loss of life in cyclones or tornadoes, property destruction in floods, crop damage from droughts, all result from weather extremes. The WMAB report estimated that measurable weather-caused damage of all types amounts to \$13 billion in the United States in an average year.² Even slight variations in snow cover or rainfall

may have important effects on crop yields (a critical factor in a developing country) or spring floods. Percentage of sunshine affects the amount of solar energy that can be produced each day.

The WMAB report argued that intensified and steady scientific inquiry over the course of the next two decades will yield:

... regionally important increases in mountain snowpack in the 1980's, increased rainfall in areas like our High Plains and Midwest by the late 1980's, reduced hurricane winds and hail damage by the 1990's. The margins of man-produced seasonal weather change would be 10% to 30% increases for snow and rain. Some hurricane winds would be reduced by 10% to 20% (with much greater reductions in wind damage). Hail would be reduced up to 60% in some kinds of storms.³

The case for increased research efforts to produce such results is very strong:

The economic benefits of delivering more water in the right places—for farming, for irrigated crops, for hydroelectric power, and for municipal and industrial water use—seem very likely to outweigh the costs by impressive amounts. Large benefits, especially to aviation, can come from dissipating fog on command. Population growth and migration are multiplying the people at risk from hurricanes and other severe storms; if the damage from the weather's occasional fury can be mitigated, the people at risk will insist that the effort be made.⁴

But the attractions of such benefits must not be allowed to obscure consideration of the risks: "The air and the clouds are a public good, belonging to no one."⁵ As the report noted, most interventions "are likely at best to operate at the margin," but

... even small increases in winter snowpack and summer rainfall, decreases in hail, and moderation of hurricane violence may be very important in a world that is edging closer to margins of safety in meeting human needs for food, fiber, energy, water and living space.⁶

The report recommended a 20-year effort in weather resources research and management, based on Federal programs and Federal coordination with state programs in particular, to allow initiation of large field experiments.⁷

In the absence of any national policy or coherent Federal regulation, however, weather modification continues to take place. In 1977, in 88 projects in 23 states, clouds were seeded over about 673,000 square kilometers of the United States.⁸ But it is unintentional modification that could

have the most dramatic long-range impact. "All facets of the weather and climate, including the temperature, humidity, clouds, precipitation, wind, visibility, and air composition, are changed by large cities," primarily through changes in the radiative and heat budgets of the atmosphere.⁹ The Board cited evidence that "in the Northern Hemisphere, urbanization produces 10% to 15% more snow and rain, 15% more thunderstorms, 60% more fog—and 1,000% more contaminants—than are found in otherwise comparable rural areas,"¹⁰ and called for technical studies on urban and industrial influences on weather (including historical investigations), studies of regional situations, analyses of land-use changes and human and environmental impacts, and social studies or organizational patterns for dealing with unintended modification, particularly establishment of effective communication between the public and the policy makers.

Major sections of the report are devoted to discussion of the "impacts and implications" for society, stressing the importance of cost-benefit analysis applied to individual weather changes. For example, there are obvious benefits to the airline industry if fog can be reduced, but such modification must also take into account the environmental and social effects on the entire region. In other cases, (for example, increasing the snow pack in ski resort areas) benefit to one segment of society may not outweigh costs to another (increased spring run-off and chance of flooding), yet the group that might suffer harm may have no control over (and often no prior knowledge of) the intentional modification.

When a choice of methods must be made, proposals must also take account of attitudes intrinsic to a technological society:

In our fast-moving technological society, we repeatedly demonstrate that we prefer, when possible, a structural solution (e.g., to develop blind flying techniques for passenger aircraft) to the adjustment of our plans in the light of even a believable forecast (e.g., to cancel a flight because visibility at our destination is low). Our plans are made too far ahead, our patterns of life are too regular, to respond easily to the weather's randomness, even if it could be foreseen with perfect assurance.¹¹

Legal considerations in weather modification operations fall into two general but interactive categories: "general rules governing the liability of any person for harm resulting from his actions," and legislation specifically intended to regulate weather modification activities. The Board recommended certain basic objectives for a legal-regulatory framework:

(a) "To ensure that operations comply with minimum standards necessary for the protection of the public;"

(b) "To exert pressure for continuous improvement in standards as the state of the art advances;"

(c) "To provide means to compensate for identifiable damages directly resulting from weather modification operations;" and

(d) "To avoid interposing unwarranted barriers to beneficial applications of the technology."¹²

Liability rules for Federal and non-Federal activities, insurance arrangements, and regulation of non-Federal activities are only a few of the topics the Board addressed. One regulatory approach, which the Board did admit is "novel," exuded the aura of science fiction: to create a new Federally-licensed profession, "perhaps called 'meteorological designer'."¹³

The Board recommended that the Federal government take direct responsibility for five functions:

(a) Licensing weather management operators—no modification project should be permitted without the on-site supervision of a licensed operator.

(b) "The Federal government should conduct an open consultation in areas and with groups likely to be substantially affected by a Federally-sponsored field experiment. The opinion of State governments should especially be taken into account," although "Federal authority would inherently have the right to go ahead even over a State objection, after a public hearing on the record, if it found a compelling national interest in doing so."

(c) "The Federal Government should issue continuously updated, environmentally sensitive 'Sound Weather Resources Management Practices,' based on state-of-the-art technology," to serve as a standard for field experiments and guidance for regulators, modifiers, organizations, courts, and arbitrators.

(d) Technical assistance should be provided to State, local authorities, and private users.

(e) "The Federal Government should make clear that its own operations are subject to claims for damage under the Federal Tort Claims Act."¹⁴

One of the key criticisms in the report is of the diffuse nature of existing Federal efforts. Small pockets of interested activity (the largest being 38 persons among the National Oceanic and Atmospheric Administration's 13,000 employees) "are vulnerable to on-again-off-again budgets, bureaucratic rivalries, and the pluralism of Congressional jurisdictions."¹⁵ The Board noted that funds have actually declined in recent years and, "as things

stand, we are tackling 20-year problems with 5-year projects staffed by short-term contracts and funded by 1-year appropriations. It is not good enough."¹⁶ Therefore, the Board recommended consolidation of Federal weather modification work in one organization, and "sufficient autonomy for that organization to produce, defend, and carry out a serious and consistent long-term program of research and development."¹⁷

International Perspectives

One of the most delicate aspects of modification is the inherent "transnational" nature of the weather itself. Cycles of wind and water that sweep across borders create a situation in which all the arguments favoring international scientific and technical cooperation "apply with special force":

The feedbacks and interactions among the atmosphere, the oceans, landmasses, and ice are not yet well understood, and, therefore, not precisely predictable. But it is the nature of weather that many of its aspects which seem "local" are in fact local manifestations of large-scale events. Conversely, what happens "locally" may influence events very far away.¹⁸

Such concern for international discussion of the impacts of climate on society is expressed with particular clarity in a report issued by the April 1978 International Workshop on Climate Issues, conducted under the aegis of the National Research Council's Climate Research Board. The report, *International Perspectives on the Study of Climate and Society*¹⁹, emphasized the uncertainty of scientific understanding in several areas—particularly the carbon dioxide cycle and the dynamics of climate change. As this report pointed out, until many of the important scientific questions are resolved, "it will not be possible to evaluate how important the socio-economic consequences of carbon dioxide production will be." Similarly, understanding of the dynamics and the socioeconomic impacts of climate is "too uncertain" to provide a proper basis for policy action:

It is the task of science to try to assist those who seek to reduce the vulnerability that causes this concern by bettering the understanding of climate variations, improving the ability to make predictions of natural variations, improving the accuracy and reliability of projections of human interference with the climate, and achieving a better understanding of the impacts of climate variations and change on society.²⁰

Four types of scientific priorities were set—in the areas of climatic information development, human influences on climate, predicting natural climate variations, and assessment of climate impacts. For each, the report emphasized that such priorities “are determined by socioeconomic importance, scientific feasibility, and the need for an international rather than national effort.”²¹

Blue skies, balmy temperatures, kaleidoscopic autumn colors—these are aspects of climate commonly assigned value in popular songs and human memory. But, as Robert McGinn discusses elsewhere in this issue of *Science, Technology, & Human Values*, society does not always agree on the value to be assigned to the environment. If climate is a resource, then can it be held a form of property? is it a common? a global common? Value may lie in the predictability of a region's climate, or in its lack of drastic deviation in temperature. It may also be considered legally as a “potential” (just as an animal hide provides the potential for leather goods). Does a society's relationship to climate change with economic development? The report pointed out that, for example, if we are viewing the “vulnerability or resiliency of a whole structure and not of a single crop,” then societies that are most economically diversified should face fewer climatic risks.²² And yet,

For all of these arguments, is it important to keep in mind changing cultural standards and expectations, which underlie notions of vulnerability and judgment of the seriousness of impacts.²³

In remarks delivered at the Workshop, Rolando Garcia of the International Federation of Institutes for Advanced Study reminded participants that, in analyzing impacts,

The structure of the society receiving the climatic impact is as important—and sometimes more important—than the nature and intensity of the climatic anomaly itself.²⁴

Furthermore,

A good harvest in the year following a bad harvest does no good. It may turn out that at no moment was there actually a shortage of food in the country—only a shortage of income to produce it.²⁵

This interplay between technological possibilities, scientific research, and the reality of social systems is a necessity in public policy. As the report emphasized, the “embedding” of scientific knowledge into many areas of policy-making is no longer an idealization. However, in the area of environmental policy, the report warned of a “a

general lack of compatibility between government and science”:

The political process is, almost by definition, limited to a time frame of something like 10 years, whereas the sort of time frame needed for climatological planning is more often 50–100 years. Clearly, issues such as employment and energy availability in the near term will occupy much more of the government's time than planning for very long-range eventualities. What alerts decision-makers to climate—for example, the impacts of recent cold winters in the United States—is usually a single dramatic situation in the present, not a probability distribution over a century. Other than at the times when a particular climatic disaster occurs, the impacts of climate on society tend to be diffuse. This situation leads to a discrepancy between private and social costs. The overall cost may be high, but the cost to each individual may be quite small. The spread over time between impact and adjustment, especially for human-induced factors, further increases the difficulty in making economic and policy decisions about climate. The direct incremental costs of regulation occur in the present, while the benefits and total societal costs are in the distant future. It is thus not surprising that even in many forward-looking policy units the planning process does not accommodate climate.²⁶

Cold Reality

The importance of discussing the policy and social issues in weather modification or climate research is shown in no more dramatic way than the harsh tragedy of earthquake, tornado, or flash flood. Technical reports from such groups as the NRC Committee on Natural Disasters frequently detail the human effects of unpredicted weather extremes as well as the consequences of brutal interaction between weather, wind, water and sociotechnical systems.²⁷ Whether the costs are loss of life or mere inconvenience, they are rarely reimbursable. As stressed in the reports described above, the issues in weather modification and global climate research are too important to be left to the cloud seeders or the farmer's almanac.

—MCL

NOTES

1. *The Management of Weather Resources, Volume I, Proposals for a National Policy and Program, and Volume II, The Role of Statistics in Weather Re-*

- sources Management (Washington, DC: U.S. Government Printing Office); Vol. I—xii + 230 pp., Stock No. 003-018-00090-3; Vol. II—108 pp., Stock No. 003-018-00091-1. Report to the U.S. Secretary of Commerce from the Weather Modification Advisory Board (Harlan Cleveland, Chairman).
2. *Ibid.*, [Vol. I], p. 17.
 3. *Ibid.*, p. 3.
 4. *Ibid.*, p. 4.
 5. *Ibid.*
 6. *Ibid.*, p. 31.
 7. *Ibid.* Volume II contains the report of a special Statistical Task Force (John W. Tukey, Chairman; David R. Brillinger; Lyle V. Jones) directed by the Board to review the published results of weather modification programs, assess the methodologies of some of the more recent field experiments, and suggest guidelines for the statistical design of future work.
 8. *Ibid.* (Vol. I), p. 6.
 9. *Ibid.*, p. 75.
 10. *Ibid.*, p. 7.
 11. *Ibid.*, p. 27.
 12. *Ibid.*, p. 147.
 13. *Ibid.*, p. 158.
 14. *Ibid.*, pp. 10-11.
 15. *Ibid.*, p. 15.
 16. *Ibid.*
 17. *Ibid.*
 18. *Ibid.*, p. 159.
 19. *International Perspectives on the Study of Climate and Society*. Report of the International Workshop on Climate Issues (Robert M. White, Chairman) to the Climate Research Board, Assembly of Mathematical and Physical Sciences, National Research Council (Washington, DC: National Academy of Sciences, 1978). Available from the Climate Research Board, 2101 Constitution Avenue, N.W., Washington, DC 20418.
 20. *Ibid.*, p. 2.
 21. *Ibid.*, p. 8.
 22. *Ibid.*, p. 23.
 23. *Ibid.*
 24. *Ibid.*, p. 43.
 25. *Ibid.*, p. 45.
 26. *Ibid.*, p. 26.
 27. For example, in the case of the July 1976 flood in Big Thompson Canyon (Colorado), over ten inches of rain, from an intense thunderstorm stalled over one end of the canyon, caused a flash flood that left 139 persons dead, 4 missing, and destroyed \$41 million in property. A National Research Council Report noted that there had been no significant flooding in the canyon for over 20 years and, "as a result, flood dangers were ignored and . . . residential and commercial development had encroached on the flood plain area" [D.B. Simons, *et al.*, *Flood of 31 July 1976 in Big Thompson Canyon, Colorado*, Report to the Committee on Natural Disasters, National Research Council (Washington, DC: National Academy of Sciences, 1978)]. In November 1977, a period of intense rainfall caused a small earth dam to break; in the resulting flood, 38 persons were killed. [G.F. Sowers, *Reconnaissance Report on the Failure of Kelly Barnes Lake Dam, Toccoa Falls, Georgia*, Committee on Natural Disasters, National Research Council (Washington, DC: National Academy of Sciences, 1978)]. By citing these reports, I do not intend to draw any connection between these particular events and specific weather modification attempts, only to demonstrate the real costs of uncontrolled weather extremes. — MCL

Meeting Report:

Remodeling the Science Journalism Curriculum

In a recent issue of *Columbia Journalism Review* (July/August 1979), three out of five articles addressed some aspect of the interaction of science/technology and the press. Such emphasis by this bellwether of journalistic concern provides some background for recent efforts among journalism educators to improve the teaching of science communication.

The *Review's* lead article, "The United States v. The Progressive,"¹ for example, analyzed the critical First Amendment issues in judicial suppression of a magazine story said to describe the "secret" of the hydrogen bomb. This controversy has combined three volatile elements—restrictions on press freedom via prior restraint on publication, persistent public fears about the use of nuclear weapons, and arguments for uninhibited and open communication of scientific information.² A second article, "Do You Love Your VDT?"³ probed reporters' reaction to the "encroachment" of new technology into the newsroom through increased use of CRT terminals, editing programs and other computer-linked devices. Such first-hand experience with the social impact of advanced technology may itself affect the quality and perspectives of future reporting on that subject. The VDT article's author, for example, admonishes journalists that "We must also learn to perceive the various levels at which technology is altering the world," and then notes:

Well, then, what really is changing? And at what level? This is precisely the problem we face in thinking about the relation of technological change and social change—and not only in journalism.⁴

In the third article, Peter Sandman and Mary Paden dissected the news reporting "At Three

Mile Island,"⁵ and described a press corps that was beset by confusion, by uncertainty about who was the authoritative source, by personal fears about the possibility of radiation poisoning, and by simple ignorance of basic nuclear technology. The authors pointed out that, according to their research, the reporters who were given the "technical assignment" of covering the Three Mile Island nuclear plant accident, "fell into four categories":

- About a third were frankly bewildered. They relaxed when the questioning turned momentarily nontechnical, took frantic verbatim notes when the going got rough and stopped writing altogether when it got rougher still. . . . These were the reporters whose recurring nightmare was that Denton would announce a meltdown in technical language and they wouldn't realize what had happened.
- Only a handful of reporters knew much about nuclear power before they reached T.M.I. They were all science and energy writers—although not all the science and energy writers qualified.
- Nearly a quarter of the reporters had a single expert on tap—a source from an earlier story, a science writer back in the office, or a paid consultant on the scene.
- The rest of the reporters made *themselves* into experts—fast.⁶

Sandman and Paden concluded that "the science writers at the scene [at TMI] weren't a lot better off than aggressive political reporters. . .":

"Unless you were a nuclear scientist," ABC energy specialist Roger Peterson later told *The New York Times*, "you didn't know what on earth was going on"—and science writers are seldom nuclear scientists.⁷

How best to teach the young journalist who, as a science reporter, may be called upon to cover any conceivable field of science, engineering, or medicine or who, as a general reporter, will undoubtedly encounter complex scientific or technical issues in routine coverage of Congress, the courts, social upheaval, or even major disasters? This problem was the subject of the Third Annual Meeting of the Science Writing Educators Group, 5 August 1979 at the University of Houston,⁸ under the theme "Innovations in Teaching Science Communication."

Few science writers or editors have had extensive formal training in either science or science journalism or both⁹ and, as the Sandman and Paden article showed, important science-related events or issues are much more likely to be covered by general or public affairs reporters. Because of this, efforts to improve science journalism courses take on added importance if the result is to attract students who may not intend to be science reporters but will find courses on communication or science and public policy as useful to their future careers as courses in government, law, or economics.

Several speakers in the morning session described their own successful teaching methods. For example, Edmund B. Lambeth (School of Journalism, Indiana University) related how he uses prize-winning articles from the AAAS-Westinghouse Science Writing Award Competition to demonstrate the presence (or absence) of qualities of "good" science writing (e.g., that it engages, entertains, and educates the reader; supplies the scientific and social context for the story; qualifies the scientific assertion; and includes "background" on the field or line of research).¹⁰ Rex Buchanan (School of Journalism, University of Kansas) described how he invites a campus researcher to visit his class and then return later for a "feedback" session, during which the scientist critiques the stories written by the students and the techniques they used in interviewing or in seeking more information.¹¹ Buchanan attempts to teach students to interact with scientists *after* the initial interview and thus counter a persistent complaint of scientists and engineers who "often must explain their work to writers . . . content with only a superficial understanding of their research" but who are rarely asked by the writers to clarify or explain confusing facts before publication.¹² [I was intrigued by Buchanan's statement that, for these sessions, he

tends to choose a scientist who "is widely respected for his research but . . . is not particularly adept at explaining his work to non-technical audiences"¹³—a touch of reality.]

Traditionally, science communication courses in journalism schools have concentrated on either (a) the physical and natural sciences and engineering, (b) agriculture, (c) home economics and nutrition, (d) medicine and public health or (e) more recently, energy and environment issues.¹⁴ S. Holly Stocking (Co-Ordinator of Science Writing Projects at the Boystown Center For Youth Development) focused her presentation on the neglect of social science reporting:

The 1960's and 1970's saw the development of . . . magazines in the social sciences, including *Psychology Today*, *Human Nature*, and *Human Behavior*. Major news magazines began to run periodic columns on the social sciences. And a number of . . . newspapers, including the *Los Angeles Times* and *Detroit Free Press*, even hired specialized "human behavior" writers. In his study of science news in metropolitan newspapers, Cole provided empirical support for this rising media interest in the social sciences. He found that social and behavioral science news rose from 4.7% of all science stories in 1961 to 14.8% of all such stories in 1971.

In spite of . . . increased interest on the part of the media, there is reason to believe that journalism educators who teach specialized science communication courses have been slow to warm to the social sciences as legitimate sources of science news.¹⁵

Stocking attempted to place this attitude in the context of certain common journalistic biases; she pointed out that, for example, in two recent studies:

. . . researchers have found that science writers from major newspapers seldom think of the social sciences when they think of science [Dunwoody, 1978; Tichenor, et al., 1970]. More often than not, the sciences for them are the physical and biological sciences. Science writers not only prefer to write about the "natural" sciences, but their training is more likely to be in these sciences [Ryan and Dunwoody, 1975]. Since many instructors of science communication have themselves been newspaper science writers, it is likely that such perceptions of the "sciences" and preferences for the "natural" sciences carry into the classroom. As one journalist-turned-educator, recently put it: "My background is in biochemistry—I'm absolutely hopeless when it comes to the social sciences!" Because of these feelings, she usually avoids making assignments in the area. Other in-

structors have told me that they do incorporate the social and behavioral sciences in their courses, but usually as "optional" assignments. Rarely do instructors seem to go out of their way to require assignments in the social and behavioral sciences. They simply don't seem to see the social sciences as important enough (or different enough) to warrant this kind of attention.¹⁶

Stocking believes that the social and behavioral sciences can significantly enlighten many common news topics, for example, family relations, busing, neighborhood and juvenile crime, or the social treatment of handicapped or retarded children. Since research findings related to such topics are frequently brought to the attention of legislators and government policymakers, they are certainly "legitimate subjects for science news" and, therefore, for science communication courses as well.

Stocking did admit that, as some journalists have also argued, "in some ways . . . the social sciences may be more difficult to cover than the physical and biological sciences":

[T]here is usually less consensus in the social sciences than there is in the natural sciences. For the science writer, this means that his scientist sources may disagree with each other more than they do in the physical and biological sciences. It also means that findings may depend more on subjective definitions and interpretations of data and on methodological considerations than do findings in the other sciences. As a result, it may be much more difficult for the science writer covering the social and behavioral sciences to separate good data from bad.

At the same time, . . . there is usually more apparent relevance to people's daily lives. [For example,] street crime, which is a subject of sociologists, is simply much more involving for the average person than black holes or supernovas.¹⁷

Stocking deftly argues that this very relevance, although it may increase interest in the subject matter, can nevertheless generate its own difficulties:

When it comes to human behavior, everyone is his own expert. If a social scientist's findings on sex differences do not mesh with those of an editor, they are likely to be dismissed as "bad science." If the findings support common sense, they are likely to be rejected as "supporting the obvious."¹⁸

Moreover, the problem of language, which is traditionally associated with communicating the

abstruse vocabulary of physics or mathematics, also complicates communication of the results of social science research:

. . . the social sciences are more likely than the natural sciences to borrow terms from everyday language—a fact that may make the subject matter appear to be "understandable" when in fact it is not. "Aggression," for example, may mean one thing to a layperson, but a very different thing to a psychologist. Similarly, "alienation" may have one meaning to the lay reporter, but a very different meaning to the sociologist. Unless a science writer realizes that the jargon of social science needs "translating" every bit as much as the jargon of medicine or physics, s/he may unintentionally distort the findings of a particular social science study. In fact, at least one study suggests that social science articles are more likely than medical science stories to be misunderstood, perhaps because the jargon of social science is more likely to have multiple meanings.¹⁹

Most discussions of needed changes in the practice of (or education for) science journalism follow arguments similar to Stocking's in that they call for sharper attention to the subtleties of science or broader coverage of the scientific enterprise by *journalists*. In the afternoon panel session chaired by Peter Sandman (Department of Journalism, Rutgers University), "Preparing Students for the Real World of Science Communication," Frank Weaver (Public Affairs Director at the Baylor College of Medicine) viewed science reporting from another perspective. He is alarmed about a growing tendency to recruit scientists or physicians as science or medicine reporters and he argues that, because these people have not been trained as journalists, they not only lack the skills of professional communicators but may also be unaware of the "watchdog" and "adversary" roles of the press and of basic issues of the freedom and social responsibility of the press. Certainly the *Columbia Journalism Review* articles cited above described many areas in which reporting on science and technology may also mean confronting complicated issues of press freedom and social responsibility. — MCL

At the Houston meeting of the Science Writing Educators Group (SWEG), members voted to expand their present activities and to begin quarterly publication of a newsletter containing resource materials for classroom use.²⁰ The newsletter's

co-editors are Sharon Dunwoody (School of Journalism, Ohio State University) and Joye Patterson (School of Journalism, University of Missouri).

Editorial contributions are welcomed and should be sent to Professor Dunwoody, SWEG Newsletter, School of Journalism, Ohio State University, Columbus, OH 43210. Persons who wish to receive the newsletter should write Professor Patterson, SWEG Newsletter, School of Journalism, University of Missouri, Columbia, MO 65201. A one-year subscription is \$8.00. The first issue of the expanded newsletter is expected in late 1979.

Prior to the Houston meeting, SWEG members had been asked to suggest future directions for the ad hoc group. The majority of the survey respondents wished to remain an informal organization for another year, but to explore later affiliation with a larger, established organization. SWEG plans to hold another science communication colloquium in August 1980, prior to the Boston meeting of the Association for Education in Journalism. Program organizer is Rae Goodell (Science Writing Program, Massachusetts Institute of Technology). Future issues of *Science, Technology, & Human Values* will contain information on the theme and plans for that meeting.

NOTES

1. Robert Friedman, "The United States v. The Progressive." 18 *Columbia Journalism Review* 2 (July/August 1979): 27-35.
2. For additional discussion of this event, see the analyses in *Science* magazine: Deborah Shapley, "H-Bomb Issue Hits Where It Hurts," 203 *Science* (30 March 1979): 1323; Deborah Shapley, "Judge Halts H-Bomb Article," 204 *Science* (6 April 1979): 38. During the week of 17 September 1979, publication of letters, containing similar material, in other magazines and newspapers caused the Justice Department to halt its suit against *The Progressive*.
3. Dominique Wolton, "Do You Love Your VDT?" 18 *Columbia Journalism Review* 2 (July/August 1979): 36-39.
4. *Ibid.*, p. 39.
5. Peter M. Sandman and Mary Paden. "At Three-Mile Island." 18 *Columbia Journalism Review* 2 (July/August 1979): 43-58.
6. *Ibid.*, p. 54.
7. *Ibid.*, p. 55.
8. "Innovations in Teaching Science Communication," 5 August 1979, University of Houston, sponsored by the Science Writing Educators Group, and the Mass Communication and Society, Theory and Methodology, and Public Relations Divisions of the Association for Education in Journalism.
9. For example, results cited in M. Ryan and S. L. Dunwoody, "Academic and Professional Training Patterns of Science Writers," 52 *Journalism Quarterly* (1975): 239-246, 290.
10. Edmund B. Lambeth, "Teaching from the Prize Winners."
11. Rex Buchanan, "Use of Researcher Feedback in a Science Writing Seminar."
12. *Ibid.*
13. *Ibid.*
14. For example, the courses and programs listed in S. M. Friedman, R. Goodell, and L. Verbit, *Directory of Science Communication Courses and Programs* (Binghamton, NY: Department of Chemistry, SUNY-Binghamton, 1978).
15. S. Holly Stocking, "Putting the Social Sciences Into Science Communication Courses," *op. cit.* (Note 8). Stocking cites D. Cole, *Science Conflict: A Content Analysis of Four Major Metro Newspapers, 1951, 1961, 1971*. Unpublished master's thesis, University of Minnesota, 1974.
16. *Ibid.* Stocking cites following: (a) S.L. Dunwoody. *The Working Science Journalist: A Study of Factors Affecting the Selection of News at a Scientific Meeting*. Unpublished doctoral dissertation, Indiana University, 1978; (b) P. Tichenor, C. Olien, A. Harrison, and G.A. Donohue. "Mass Communication Systems and Communication Accuracy in Science News Reporting." *Journalism Quarterly* 47 (1970): 673-683; (c) Ryan and Dunwoody, *op. cit.* (Note 9).
17. *Ibid.*
18. *ibid.*
19. *Ibid.* Stocking cites: N.A.F. Lium. *The Effects of the Use of Scientific Terms in Newspaper Articles on Their Communication Accuracy*. Unpublished master's thesis, University of Minnesota, 1977.
20. See "Science Writing Discussed by Journalism Association." 3 *Newsletter on Science, Technology, & Human Values* 21 (October 1977): 4-6, for description of the formation of SWEG.

News Items

EMPLOYMENT: SMALL GAINS FOR SCIENTISTS AND ENGINEERS

The number of scientists and engineers employed in universities and colleges increased 3 percent between 1977 and 1978. A 5-year trend toward increasing employment of part-time science and engineering personnel in academic institutions was reflected by a 7% increase in part-timers in 1978 compared to a 2% growth in full-time scientists and engineers. A recent NSF study reports that the academic sector expanded in the major disciplines—engineering, physics, environmental sciences, mathematical and computer sciences, life sciences, psychology, and social sciences—the number of life scientists increasing at the fastest rate in both relative and absolute terms.

The number of women employed full-time as scientists and engineers at universities and colleges increased 5% in 1978 compared to a 2% rate for men. Since 1974, when NSF began collecting science and engineering personnel data by sex, the growth rate of women personnel has exceeded that for men in all major S/E disciplines. However, the proportion of female full-time S/E

employees to the total remains nominal in all areas. For example, although women engineers increased 19% in 1978, they still fill less than 3% of the engineering positions in all academic institutions. Copies of the report, "Academic Scientists and Engineers Increased 3 Percent in 1978," (NSF 79-315) may be obtained from the Division of Science Resources Studies, National Science Foundation, Washington, DC 20550. You may also obtain copies of the 1978 *Detailed Statistical Tables* (NSF 78-318) and information on the availability of data tapes from the same address.

NSF data on the distribution of scientists, engineers, and technicians in manufacturing industries show that in 1977 manufacturing industries with relatively high concentrations of scientists and engineers (such as petroleum refining, chemicals, and electrical equipment) grew at a significantly faster rate, measured by total employment, than industries with low concentrations (such as apparel, leather products, and printing and publishing). Industries with high S/E concentrations showed total employment gains of 17% from 1965 to 1977, and 4% from 1970 to 1977. Industries with low S/E concentrations grew at a rate of 4% from 1965 to 1977 and showed a slight employment de-

cline from 1970 to 1977. These and other data are based on a survey conducted for NSF by the Bureau of Labor Statistics of over 100,000 manufacturing establishments, covering average annual employment in calendar year 1977. Copies of the report on the manufacturing industries (NSF 79-307) are available free from the Division of Science Resources Studies, National Science Foundation, 1800 G St., N.W., Washington, DC 20550.

NEW RESOURCES AND PROGRAMS FOR HANDICAPPED SCIENTISTS

Several national programs and two new publications remind us of the special abilities and needs of handicapped scientists.

A *Resource Directory of Handicapped Scientists* published by the American Association for the Advancement of Science (AAAS) identifies handicapped individuals in all scientific disciplines who can share their scientific expertise and experience as handicapped persons with government agencies, Congress, scientific societies, educational institutions, and organizations of and for handicapped individuals. In its publication announcement, the

AAAS writes "The impressive accomplishments of the handicapped professionals listed should go far to dispel myths about the supposed limitations of the handicapped." Among those persons listed are blind experimental chemists and biologists, deaf engineers and physicians, and quadriplegics in fields from meteorology to aerospace. Many of these scientists are available to consult on laboratory or curriculum adaptations for handicapped students, architectural or program accessibility, to describe the personal coping strategies which they have used, and to consult in their respective scientific disciplines. Educational institutions, in their efforts to comply with Section 504 (requiring non-discrimination towards the handicapped in federally funded programs) are still grappling with its implications for the teaching of laboratory sciences. Many of these scientists can provide advice on teaching techniques and special accommodations for handicapped students. Copies are available for \$3.00 (including postage and handling) from the Office of Opportunities in Science, AAAS, 1776 Massachusetts Avenue, N.W., Washington, DC 20036; telephone (202) 467-4496 (voice or TTY).

The AAAS has also recently published *Science for Handicapped Students in Higher Education*, a report that identifies and analyzes the barriers which prevent many handicapped students from obtaining a science education at or beyond the college level, and describes some of the solutions which have proved successful. The report summarizes the findings of a conference, the results of surveys of students and scientists who described their educational experiences in sci-

ence and subsequent work in the field, and research of literature. Specific barriers of attitude, information, communication, environment, academics, and finance are discussed in the publication, which includes an extensive bibliography. Copies are available for \$3.00 (including postage and handling) from The Office of Opportunities in Science, AAAS, 1776 Massachusetts Avenue, N.W., Washington, DC 20036; telephone (202) 467-4496 (voice or TTY).

The AAAS Office of Opportunities in Science, under a grant from the Bureau of Education for the Handicapped of the U.S. Department of Health, Education, and Welfare, has also recently begun a study of the education and career experiences of handicapped women scientists. Drawing on data collected through previous research projects, the study will: (1) present a general picture of the women's education, (2) highlight unique situations and critical events, (3) compare their training and work lives to men's and other women's (minority and non-handicapped), and (4) recommend changes for improving educational systems.

Also, under the leadership of William Spencer, M.D., the Department of Health, Education and Welfare is establishing a new National Institute of Handicapped Research. When organized, the institute will coordinate all federal policy on handicapped research and educate the public and health professionals about rehabilitation. For more information, write: Office of Human Development Services, U.S. Department of Health, Education and Welfare, Washington, DC 20201.

EMPLOYMENT: NRC REPORT ON WOMEN IN ACADEME

During the last decade the development of special programs to attract women to scientific careers, formation of associations of women scientists, and, most especially, a proliferation of studies have focused special attention on the training and employment of women scientists and engineers. Efforts to assess the status of women scientists and engineers had been hampered by an absence of systematic and comprehensive data, in part because, although "scientific manpower has been the subject of many analyses since World War II . . . scientific womanpower—about one-tenth of the scientific doctoral labor force—has received little attention until recently, when equal opportunity legislation required employers to perform utilization analyses of their labor force." Now, thanks to the National Research Council's Survey of Doctorate Recipients (initiated in 1973 and conducted biennially since then), detailed employment statistics on a national sample of all science and engineering Ph.D.s provide data to corroborate anecdotal accounts of discrimination and success. A recent report prepared by the Committee on the Education and Employment of Women in Science and Engineering of the NRC Commission on Human Resources, *Climbing the Academic Ladder: Doctoral Women Scientists in Academe*, uses this data to assess the status of women scientists in academic institutions. Chaired by Lilli S. Hornig (Executive Director of Higher Education Resource Services, Wellesley College), the Committee was established to "analyze the social and institu-

tional constraints that limit the participation of women in science and engineering and to examine the problems of sex discrimination in their education and employment." Academic institutions were chosen as the focus of this first report because they are the prime employers of doctoral scientists, the hierarchy of ranks is well-defined, they are the sites of special efforts in Affirmative Action and Equal Employment Opportunity programs, and "faculty status represents the quintessential scientific career." In particular, the committee analyzed extensive trend data on the education and employment of men and women doctoral scientists in order to see "whether and to what extent earlier patterns of faculty appointments have changed since the advent of affirmative action regulations."

Climbing the Academic Ladder finds that, despite some progress, doctoral women scientists in academe still trail well behind men in salary, faculty rank, and tenure status. In richly documented chapters, the study examines: (1) Constraints, Barriers and Potential; (2) The Supply of Women Doctorates; (3) Postdoctoral Training; (4) Academic Employment; and (5) Participation in the National Science Advisory Apparatus. A concluding section, Perspectives and Prospects, touches briefly on equity in academic employment and the effectiveness of affirmative action while building to a series of recommendations directed to the Federal Government and academic institutions.

Some Key Findings

(A) "On the average, as measured by college grades and high school test scores, women scientists at receipt of the doctorate

show evidence of higher academic ability than men and, in recent years, have completed their Ph.D.s as fast as or faster than men. This finding supports the inference that women may have been more highly selected."

(B) "Of the new Ph.D.s who were seeking postdoctoral appointments, the men were in general more likely to receive early awards."

(C) "The universities ranked highest by R&D expenditures, which have traditionally employed the fewest women, have made the greatest relative gains in appointing new women faculty at all ranks, in spite of the fact that this group of institutions sustained the lowest growth rates in the sciences in recent years."

(D) "Women science faculties increased about three times faster than total faculty growth between 1973 and 1977."

(E) "Science faculties at ladder ranks in all institutions increased by 22,000 between 1973 and 1977; women's share of that increase was 21%, somewhat larger than their share of doctorates since 1970. This finding suggests that some women faculty were recruited from among long-term postdoctorals and research staffs."

(F) "Women's distribution among faculty ranks is a mirror image of men's; women are most likely to be assistant professors but men are most likely to be full professors. In the top 25 institutions, women are more than seven times more likely than men to be at the rank of instructor/lecturer; in 1977 they held 46% of these positions compared to 27% in 1973."

(G) "Rank for rank, women faculty continued to be tenured less often than men; for all ranks, 72% of the men but only 46% of the women hold tenure appointments.

This disparity is increasing."

(H) "Sex differences in salaries remains a serious problem. Median salary differentials between women and men in 1977 varied by fields, ranging from as high as 28% for full professors of chemistry."

(I) "In relation to the pools of new women Ph.D.s in the various fields, chemistry and mathematics employ far lower proportions of women faculty than do other fields."

(J) "The Alcohol, Drug Abuse, and Mental Health Administration, the National Institutes of Health, and the National Science Foundation have shown marked gains in the percentages of women appointed to advisory committees, while the National Research Council has not yet matched the representation of women in the appropriate doctoral pool."

(K) "In the past few years, women have been 6 to 8 percent of the newly elected National Academy of Science members, more than twice their share of full professorships in high-ranking research universities."

While the study indicates that the status of women doctorates in academic science has improved in the past decade, it also shows that further gains are necessary before equal opportunity is realized. To promote better utilization of doctoral women scientists, the committee recommends the establishment of several kinds of fellowship and training programs, improved monitoring of equal opportunity policies, and, at the institutional level, more careful attention to the disproportionately high number of women appointed to "off-ladder" positions. *Climbing the Academic Ladder* concludes that, as corporate entities, universities must assume "a more cooperative attitude for equal opportunity for women."

Much of the cost of affirmative action is due to the adversary position taken by universities initially, and to their continuing efforts to claim a form of autonomy to which the use of public funds does not entitle them. Academic freedom does not transcend the law. It is our hope that the suggestions we have made will contribute to greater cooperation between universities and the Federal Government and a lessening of the adversary climate surrounding equal opportunity problems.

Climbing the Academic Ladder: Doctoral Women Scientists in Academe. Committee on the Education and Employment of Women in Science and Engineering; Commission on Human Resources, National Research Council (Washington, DC: National Academy of Sciences, 1979), 170 pp. Available from the NAS Office of Publications, 2101 Constitution Ave., N.W., Washington, DC 20418. ISBN 0-309-02880-9; \$8.00.

THE SOCIETY FOR THE STUDY OF PROFESSIONAL ETHICS

The Society for the Study of Professional Ethics (SSPE) will meet in conjunction with the Eastern Division meeting of the American Philosophical Association, 27-30 December 1979, at the Sheraton Centre Hotel, New York City. Two sessions are scheduled: "Rights in Regulation of Toxic Substances: Beyond Games Theory" (Mark Sagoff, Cornell University), and "Mixed Loyalties and the Professional's Ethics" (Carleton Dallery, Bryn Mawr Hospital, and Stephen Antler, Boston University). The SSPE will also meet on 24-26 April 1980 in conjunction with the Western Division, American Philosophical Association, in Detroit, Michigan.

Papers on ethical issues in the professions are invited. Deadline for submission is 15 November 1979; papers should not exceed 12-13 pages. Write: Professor Sheri Smith, SSPE President, Department of Philosophy, Rhode Island College, Providence, RI 02908.

SSPE has been established to provide an interdisciplinary, inter-professional forum for consideration of ethical questions and related conceptual problems associated with professional practice. Dues are \$7.50 and may be sent to Professor Smith at the above address. The group's activities include encouraging discussion of applied ethics, sharing materials among those who teach professional or business ethics, presenting workshops on ethics at meetings of professional associations, comparing experience and interests among individual members, and acting as resource persons to groups desiring to draft ethical codes or appoint ethics boards. Past meetings and symposia have focused on: (1) ethics and education of professionals; (2) the role and function of professional societies in ethics and professionalism; (3) codes of ethics as definitions of professional responsibility; and (4) the development of descriptive and prescriptive models of the professional/client relationship in different professions, in different contexts.

OBSERVATIONS ON THE FIRST STUDENT PUGWASH CONFERENCE

From 18-25 June 1979, over a hundred students and faculty from throughout the U.S. met in La Jolla, California for the First Student Pugwash Conference [4 *Science, Technology, & Human*

Values 25 (Fall 1978): 33]. An offshoot of the Pugwash Conferences held annually since 1957, the conference offered young scientists the opportunity to debate and discuss with some of the Pugwash founders and dons a variety of issues in "Science and Ethical Responsibility."

Science, Technology, & Human Values has received the following report on the conference from Horace Herring, who is a graduate student in Washington University's Technology and Human Affairs Program:

"It was a conference for the young and the old, the young being the students of today, for the most part idealistic and energetic, whose vision of a peaceful and caring world had yet to be tested. The old were of the generation that had created the atomic bomb, that had struggled first to create a weapon to end war, and had then spent the last 25 years striving to see that it would never be used again. . . .

"Ever since the First Pugwash Conference, the participants (who are an informal and influential group of international physicists, chemists, biologists and social scientists) have, in the words of the historian and founder member Joseph Rotblat, shown that:

. . . even when dealing with highly controversial matters, it is possible to tell the truth, without being abusive, to be candid, without trying to embarrass, provided that there is a common approach based on scientific objectivity and mutual respect. [*Scientists in the Quest for Peace: A History of the Pugwash Conferences*. Cambridge, MA: M.I.T. Press, 1972.]

Not only are the views of the Pugwash scientists controversial, but their work is also; they not only seek to reduce the threat of nu-

clear war through arms control agreements but some also research new weapon systems and advise their governments on defense policy. Many anti-war radicals claim that this is a contradictory role. How can they be trying to lessen the risks of nuclear war when at the same time they are developing new and more destructive weapons?

"This criticism lies at the heart of the old dilemma of political activists: where is one most effective—working within the 'system' or opposing it from without? This is a crucial issue for sensitive students seeking to control the spread of nuclear weapons and the arms race, who must ask themselves 'where would I be most effective: working within the Defense establishment where I have access to information and policy makers, or working outside it in citizens' groups trying to substitute political power, through mobilization of the people, for knowledge and access? As a scientist where does my social responsibility lie? What is the ethical position on such a matter?"

"For over twenty years, the Pugwash Conferences have directly raised the issue of the social responsibility of the scientist. Their efforts to [examine this question] have led them [also] to become involved in such topics as science policy, environmental pollution, 'genetic engineering,' and the problems of developing countries. In the field of arms control, their efforts at reaching international agreement [have significantly affected] the Test Ban Treaty in 1963, the Strategic Arms Limitation Talks (SALT) Treaty in 1969, and the SALT II negotiations, which concluded this year after 7 years of discussion.

"Pugwash has undoubtedly achieved much in the field of

international cooperation, but as the existing scientists involved age, they must [ask if today's] students, after a decade of anti-war and anti-nuclear sentiment, will be willing to devote their lives to research on nuclear weapons. After the anti-Vietnam war campaigners portrayed the Defense Department as the ultimate in horror and destruction, are students now willing to go and work for it? Whom will they listen to?

"Although the dominant topic of discussion [at the student conference] was the SALT II Treaty and future strategies for disarmament, other topics . . . discussed in daily workshops (which to ensure free and frank discussion were closed to the public) included biomedical research and its social implications, scientists and defense policy, scientists and political activity, scientific knowledge and human values, and technology and the needs of developing countries. The last of these is not usually thought of as a Pugwash activity, but it has been a discussion topic since the Third Conference in 1958 and one conference, the 15th in 1965 in Addis Ababa, Ethiopia, was devoted [entirely] to 'Science in the Aid of Developing Countries.'

"One difference between this conference and the old Pugwash [conferences], which I think is a reflection of the events of the last decade, is that the students did not all identify themselves as scientists nor did they lay claims to the value of a 'scientific' approach to problems. For in the 1950's, science was seen as capable of solving problems, an optimism reflected in Professor Rotblat's statement that 'Pugwash Conferences have shown that it is possible to apply the scientific approach to problems which are only indirectly re-

lated to science.'

"Nowadays students are more skeptical about the merits of the scientific approach, but are still as enthusiastic as ever about the need for more international communication, cooperation and conferences. Political structures and activity are seen as all-important; objectivity, rationality, tolerance for dissent and respect for opponents (the scientific approach?) are seen as less obvious. Perhaps the great lesson the old Pugwash scientists can pass on to the young ones is not their scientific knowledge but their humanist values.

"To students looking for a 'solution' to the arms race or an easy answer to the moral problem of population control, or a painless way to fulfill their social responsibility as research scientists, the Conference was not a success. But to those who realize that problems are not cast in black or white, that answers are not just good or bad, the Conference gave an understanding of the complexities, both technical and ethical, of current international problems, particularly in the field of nuclear weapons and arms control. Its success can be judged by the fact that plans were immediately being made for another one; maybe this student optimism shows that the old vision of Pugwash still lives on. . . ."

FIRST PROGRAMS IN 1979-80 "NOVA" SERIES SEASON

In October 1979 the PBS Series "NOVA" launched its new season of thirty-one programs. Written transcripts are available approximately one month after the air-date (single copy, \$2.00; orders of twenty or more, \$1.00 each). To

order, send a check to NOVA, "[Program Title]," P.O. Box 1000, Boston, MA 02118. Airdate given is for first WGBH-Boston broadcast; in other areas, check local listings.

A Plague on our Children [new]—Is the chemical industry a boon to modern civilization, or a major threat to our health and that of future generations? A special two-hour season premiere, "A Plague on Our Children" looks at dioxins and PCB's: manufacture and use of both are currently banned in the U.S., but they have left a legacy of possible health disasters and scientific disputes around the world. This NOVA examines the residual effects of chemical defoliants and herbicides used in both the forestry industry and home gardens, and the legacy of chemical waste dumps. WGBH Production. Airdate: 2 October 1979 (two hours).

Life on a Silken Thread [new]—Sinister, sometimes even deadly, spiders have little popular appeal; yet their silken webs are among nature's loveliest creations. Seen in closeup and slow motion, spiders reveal a delicate grace and beauty, and an amazing array of lifestyles. Based on a Maran Film Production produced by Horst Stern. Airdate: 9 October 1979.

Sweet Solutions [new]—Sugar is an edible symbol of the good things in life. It's also blamed for an increasing number of health problems. Yet the world continues to consume sugar in huge quantities—eighty million tons a year—and no one has yet discovered anything to replace it. BBC/WGBH Co-production. Airdate: 16 October 1979.

Icarus' Children [repeat]—Birds do it. Bugs do it. Why not people? "Icarus' Children" documents the history of man's fascination with

man-powered flight, including the recent success of the Gossamer Albatross, the first man-powered aircraft to make it safely across the English Channel. BBC/WGBH Co-production. Airdate: 23 October 1979.

Race for Gold [new]—At the 1976 Olympics, East German athletes walked off with 40 of the coveted gold medals. Was a drug responsible for their incredible success—or is American athletic training and commitment falling behind that of the Communist world? "Race for Gold" focuses on athletic training, particularly for Olympic contenders. The program raises the controversial issue of drugs, forbidden by Olympics rules but increasingly implicated as a factor in many victories. For this film, NOVA was allowed into a top East German athletic training club—the first Western film crew to gain access to a system of sports training that is guarded like a military secret. WGBH Production. Airdate: 30 October 1979.

All Part of the Game [new]—Thousands of amateur athletes are hurt every year, and many professional athletes suffer injuries that may mean the end of a career. Now a new medical specialty promises to prevent and cure many sports-related problems. "All Part of the Game" considers the risks-versus-benefits aspect of sports training, and shows how sports medicine aims to help both amateur and professional athletes to maximize training benefits while avoiding disabling injuries. WGBH Production. Airdate: 6 November 1979.

The Case of the Ancient Astronauts [repeat]—Is it possible that astronauts from other worlds have visited Earth? NOVA examines the evidence for these popular theories. BBC/WGBH Co-production. Airdate: 13 November 1979.

India: Machinery of Hope [new]—Most of India lives by the same rhythm, the same tools, as in centuries past. But there is another India—with thriving commercial centers, spotless research laboratories and large-scale industry. The gap between these two extremes is shrinking because of a policy of appropriate technology (AT) that uses the resources of both to meet the greatest needs of all. This WGBH production includes interviews with AT advocate Georges Fernandes and former Prime Minister Moraji Desai. Airdate: 20 November 1979.

The Bridge That Spanned the World [new]—The Iron Bridge across the River Severn in Telford, England, is two centuries old this year. It remains a monument to the Shropshire ironmasters who built it, and a symbol of the Industrial Revolution that was born in the area where the bridge stands. NOVA traces the development of ironmaking and its far-reaching effects on society and the world economy. BBC/WGBH Co-production. Air date: 4 December 1979.

Termites and Telescopes [new]—Dr. Philip Morrison, Institute Professor and Professor of Physics at Massachusetts Institute of Technology, presents a thoughtful and provocative commentary on the rise of civilization and on the differences between animals and man. BBC/WGBH Co-production. Airdate: 11 December 1979.

Blindness: Five Points of View [new]—For many people the idea of life without vision is as fearful as death. NOVA looks at five people struggling to save their threatened vision using drugs, surgery, counseling and determination. WGBH Production. Airdate: 18 December 1979.

Subjects of other programs, to be

shown in 1980, include: bowhead whales and the controversy over Eskimo hunting; a portrait of Edward Teller; medical care in Nigeria; a year-long portrait of a salt water bay; the battle of man versus locust; high blood pressure; an amazing forestry and farming experiment in the Amazon jungle; and an attempt to control pollution in the Mediterranean Sea through international cooperation.

RULES AND PUBLICATIONS: THE NATIONAL COMMISSION FOR THE PROTECTION OF HUMAN SUBJECTS OF BIO- MEDICAL AND BEHAVIORAL RESEARCH

The 14 August 1979 *Federal Register* contained the formal rules proposed by the U.S. Department of Health, Education and Welfare to require institutional review boards at institutions receiving HEW funding. The rules would require IRB approval for research involving human subjects at these institutions whether or not the research in question is supported by federal funding. IRB review would be required, regardless of the amount of risk involved, unless the research was specifically exempted. Comments on the proposed regulations must be submitted by 12 November. Direct inquiries to F. William Dommell, Jr., Assistant Director for Regulations, Office for Protection from Research Risks, National Institutes of Health, 5333 Westbard Avenue, Room 3A18, Bethesda, MD 20205; (301) 496-7163.

The deliberations and final report of the National Commission, as well as special papers and related materials, have been brought

together in a series of recent government publications:

(1) *The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects—Final Report* (Washington, DC: U.S. Government Printing Office, 1978), 20 pp., Stock no. 017-040-00433-8, \$1.50; *Appendix, Volume I* (Washington, DC: U.S. Government Printing Office, 1978), 565 pp., Stock No. 017-040-00434-6, \$7.50; *Appendix, Volume II* (Washington, DC: U.S. Government Printing Office, 1978), 648 pp., Stock No. 017-040-00435-4, \$9.00.

(2) *Ethical Guidelines for the Delivery of Health Services by DHEW—Report and Recommendations* (Washington, U.S. Government Printing Office, 1978), 106 pp., Stock No. 017-040-00431-1, \$3.00; *Appendix* (Washington, DC: U.S. Government Printing Office, 1978), 368 pp., Stock No. 017-040-00432-0, \$7.50.

DHEW ETHICS ADVISORY BOARD: PROPOSED EXEMPTIONS TO THE FREEDOM OF INFORMATION ACT

On 14-15 September 1979, the Ethics Advisory Board of the Department of Health, Education and Welfare heard testimony on proposed exemptions to disclosure required by the Freedom of Information Act. Notice of the meeting and the text of the proposals were published in the *Federal Register* for 1 August 1979 (Vol. 44, No. 149). The specific exemptions would apply to data relating to (1) institutions and individuals cooperating with epidemiologic investigations conducted by the Center for Disease Control (CDC); and (2) research

being conducted by the National Institutes of Health (NIH), where the data are incomplete.

The CDC proposal would amend the Public Health Service Act to authorize the Director of the Center for Disease Control to issue assurances of confidentiality to health care providers who voluntarily make data available to that agency. No information which identifies them will be disclosed except under certain specified conditions. It is intended that the amendment continue to permit CDC to freely share the identity of health care providers with state health departments. It would also prohibit further disclosure of the identity of the provider unless the provider has publicly revealed the fact that it has participated in a disease investigation or consents to disclosure. The proposed amendment does not restrict CDC's ability to release data, data analyses, conclusions and recommendations arising from disease investigations, epidemiologic studies or monitoring processes.

The NIH proposal for protection of research data under the Freedom of Information Act is intended to protect from disclosure data from clinical trials and observational epidemiological studies which are preliminary, incomplete, or not yet validated. The *Federal Register* notice pointed out that:

The Freedom of Information Act (FOIA) contains three exemptions which may pertain, in some instances, to scientific research information. However, none of the FOIA exemptions adequately protects or even addresses the issue of disclosure of scientific research data. The absence of protections for preliminary data and the growing number of requests for such information have led to the concern that

premature findings will be released which could jeopardize the public health and be fatal to the successful completion of much important research. As several recent court decisions have pointed out, the release of information about federally conducted or funded research is, in many cases, required by the FOIA. Whether or not scientific research data must be disclosed depends upon the legal relationship between the investigator and the Federal Government.

As the *Register* statement points out, there are many reasons why premature disclosure of research data may be undesirable:

One is the fact that a scientist's ideas are his only stock in trade. The scientist has a proprietary interest in being allowed to develop his or her own ideas and to control the release of those ideas. Ultimately, those ideas, like those of an artist or author, may deserve commercial protection.

The nature of the research endeavor is such that it is essential to assure that results of the scientific process are released when they will most effectively promote the public good. Since the final conclusions drawn from research data are quite different from preliminary findings, a crucial part of the scientific process must be the validation and evaluation of the data obtained during the experiment or trial. The validation process eventually includes peer review of the research findings, finally resulting in publication. Peer review prior to acceptance for publication includes a careful scrutiny of the experimental design and, where appropriate, affirmation of the statistical validity of the conclusions. Premature disclosure interrupts the process of validation. The result may be release of misleading data.

The NIH proposes that "a statutory amendment be drafted to protect from disclosure data from clinical trials and observational epidemiological studies

which are preliminary, incomplete, or not yet validated. Withholding these data from disclosure should depend upon a determination that their release would jeopardize the conduct, completion, or validity of the research project." This proposal is not, however, intended to change the requirements relating to the rights of human subjects in clinical trials and the Board adds that the proposal "must be carefully drafted" to allow release of data if there is indication of the likelihood of human injury. The Board also included some questions for discussions: (1) Should the amending language be limited as proposed or should it include protection for the premature release of data from any scientific research of potential importance to the nation's health? (2) Should the authority to withhold from disclosure ideas, novel experimental techniques, data, or even a scientist's conclusions, be time-limited and, if so, who should decide when and for what reasons information should be withheld? (3) What if the only justification for withholding data from the public is protection of the scientist's ideas? Should a research proposal be given some degree of protection before or during agency review, after a funding commitment is made, or only if funding is denied? (4) At present, under the Freedom of Information Act, data are treated differently, depending upon whether they are obtained by intramural or extramural scientists. Should all data be treated in the same way? (5) Should any statutory remedies for protection of preliminary research data include an initial administrative mechanism for resolving disputes, or is the current availability of judicial review adequate?

Requests for information should be addressed to Ms. Roberta Garfinkle, Westwood Building, Room 125, 5333 Westbard Avenue, Bethesda, MD 20016; telephone (301) 496-7776.

DHEW ETHICS ADVISORY BOARD:

IN VITRO FERTILIZATION

Since September 1978, the Department of Health, Education and Welfare Ethics Advisory Board has been considering the scientific, legal, ethical, and social issues surrounding human *in vitro* fertilization and embryo transfer in general. The Board's report published in the 18 June 1979 *Federal Register* found that such research is "ethically defensible but still legitimately controverted," but emphasized that it did not consider the ethical considerations against such research to be insubstantial. Four issues were singled out by the Board as especially difficult—the moral status of the embryo, the safety and efficacy of the procedure, the potential long-range adverse effects of such research, and the appropriateness of DHEW support:

A. After much analysis and discussion regarding both scientific data and the moral status of the embryo, the Board is in agreement that the human embryo is entitled to profound respect; but this respect does not necessarily encompass the full legal and moral rights attributed to persons. . . .

B. The Board is concerned about still unanswered questions of safety for both mother and offspring of *in vitro* fertilization and embryo transfer; it is concerned, as well, about the physical and mental health of the children born following such a procedure and about their legal status. . . .

C. . . Although the Board recognizes that there is an opportunity for abuse in the application of this technology as other technologies, it concluded that a broad prohibition of research involving human *in vitro* fertilization is neither justified nor wise . . .

D. . . The Board concluded that it should not advise the Department on the level of Federal support, if any, of such research; but it concluded that Federal support, if decided upon after due consideration of all that is at issue, would be acceptable from an ethical standpoint.

In addition to the recommendations, the report contains accounts of the evolution of the ethical debate, history of the scientific research and clinical use of such procedures, review of the legal issues, and a review of pertinent public attitudes. On the last point, national polls conducted since July 1978 by both George Gallup and Louis Harris indicate that although majority opinion favors *in vitro* fertilization, most women in one survey opposed IVF until further testing had established safety and efficacy, yet 50% opposed federal funding of such research. The report published in the *Federal Register* is also available from the U.S. Government Printing Office, as is the appendix that contains (a) papers prepared for the Board by scientists and scholars in law, ethics, theology, statistics and social policy, (b) results of the public opinion polls, and (c) series of correspondence between the Board and Drs. Steptoe and Edwards. *Report and Conclusions: HEW Support of Research Involving Human In Vitro Fertilization and Embryo Transfer*; 132 pages; Stock No. 017-040-00453-2; \$4.00. *Appendix: HEW Support of Research Involving In Vitro Fertilization and Embryo Transfer*; 860 pages;

Stock No. 017-040-00454-1; \$15.00. Orders should be addressed to: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone (202) 783-3238. For a list of the publication numbers and prices of the public hearings transcripts available from the National Technical Information Service, write either NTIS or the Ethics Advisory Board, Westwood Building, Room 125, 5333 Westbard Avenue, Bethesda, MD 20016.

FUNDING: STS EDUCATION

During FY 1980 the National Science Foundation's Development in Science Education (DISE) Program will focus on the area of Science, Technology and Society. DISE supports the development of novel approaches and/or materials which have potential for nationwide impact, in this particular case concerning the interrelationships between science, technology and society; for example, teaching future or present scientists about the ethical and social impact of scientific work on society or teaching non-scientists about how science impacts on the important social and/or value issues they confront in their daily lives. Preliminary proposals should be submitted by 30 November 1979. For further information, contact Gene D'Amour, Development in Science Education, Directorate for Science Education, Division of Science Education Development and Research, National Science Foundation, Washington, DC 20550; telephone (202) 282-7910.

FUNDING: NSF PROGRAM FOR THE ANALYSIS OF SCIENCE RESOURCES

The NSF Division of Science Resources Studies is responsible for the development and analysis of data pertaining to U.S. scientific and technological endeavors. The Division prepares and publishes analytical reports (including the National Science Board's biennial report, *Science Indicators*) and funds other projects under its Program for the Analysis of Science Resources, on the subjects of training and employment of scientific and technical personnel, funding of scientific and technical activities, scientific and technical employment forecasting activities, and quantitative studies of the impacts and outputs of scientific and technological activities. The SRS program seeks: (a) Development of in-depth and issue-oriented analyses of scientific and technical personnel and/or science and technology funding and performance using SRS and related data; (b) Development of new or improved techniques for analyzing science resources data and their relationships with other variables; (c) Development of forecasts and forecasting techniques for demand and supply of scientific and technical personnel, and for R&D expenditures; (d) Development of new indicators measuring impacts and outputs of scientific and technological activity, particularly, though not exclusively, indicators of technological innovation; and (e) Development of modeling techniques that describe key interactions among important components of the economic system as they relate to science and technology. Most awards under the program are expected to be in the \$50,000 range. Proposals

may be submitted at any time but those received after 8 February 1980 will probably not be considered for funding until FY 1981. For a copy of the Program Announcement (NSF 78-47, rev.), write: Program for the Analysis of Science Resources, Division of Science Resource Studies, National Science Foundation, 1800 G Street, N.W., Washington, DC 20550.

CONFERENCE: ETHICAL ISSUES IN GOVERNMENT

On 8-9 November 1979, the University of Delaware Center for the Study of Values will sponsor its third values conference, focusing this year on ethical issues in government. Topics to be considered include: (1) conflicts of interest; (2) what is the nature of the public good; (3) to what extent should a legislator serve his/her conscience or his/her constituents. For further information, write: Norman E. Bowie, Center for the Study of Values, University of Delaware, Newark, DE 19711.

CONFERENCE: CHANGING VALUES IN MEDICINE

As the focus of medical care turns from the disease to the sick person, the consequent gradual but fundamental changes in medicine demand new methods, tools, and theories for action. On 11-13 November 1979, the Cornell University Medical College will sponsor a conference on the "Changing Values in Medicine" at the Statler-Hilton Hotel, New York City. Major sessions will address

the following topics: "The Attending Physician as Central Figure," "On the Nature and Limits of Clinical Medicine," "What Does the Word 'Good' mean in 'Good Patients'?", "The Use of Subjective Information in Clinical Patient Care," "Medicine Aimed at the Care of Persons: Social and Political Implications," "New Understanding of Causality in Medicine," "What Does the Word 'Good' Mean in 'Good Physician'?", and "Necessary Changes in Medical Education." Conference Chairpersons are: Eric J. Caspell, M.D., (Cornell University Medical College) and Mark Siegler, M.D., (The University of Chicago School of Medicine).

CONFERENCE: INTERRELATIONSHIPS BETWEEN THE INDIVIDUAL, THE HEALTH CARE PROFESSIONAL, AND SOCIETY

On 1 December 1979, the Brown University Bioethics Association will sponsor "Health: Whose Responsibility?", their second annual undergraduate biomedical ethics conference. Undergraduates are invited to give papers on a wide range of topics focusing on the interrelationships between the individual, the health care professional, and society. Suggested topics include (but are not limited to): Is health care a right? Do individuals have a duty to maintain their own health? How ought we to allocate our limited medical resources? Should the government have the right to make or regulate health care decisions for the individual? Any student may give a talk of up to fifteen minutes long. Short abstracts or rough drafts should be submitted by 9 Novem-

ber. All abstracts must include a paper title, student's name, address, and telephone number. Registration fee for the conference is \$3.00 (\$1.00 with Brown ID); additional \$6.00 for the conference dinner. Registration deadline is November 16. Free guest housing is available in Brown University dormitories. For information, contact Carol Cusson and John Sopper, Conference Co-Chairpersons, Brown Bioethics Association, Box 1930, Brown University, Providence, RI 02912.

CONFERENCE: LITERATURE AND SCIENCE

This December marks the 40th Anniversary of the Division of Literature and Science of the Modern Language Association. The theme for this year's meeting (28 December 1979, 1:00 p.m., St. Francis Hotel, San Francisco, CA) is "Literature and Science: Critical Approaches and Perspectives." The program organized by Walter Schatzberg (Clark University) includes: (1) "Literature, Science, and Language," E. Fred Carlisle (Michigan State University); (2) "Recent Theories of the History of Science: Their Implications for Historians of Literature (Lakatos, Feyerabend, Laudan)," John Neubauer (University of Pittsburgh); (3) "The Rhetoric of Science in Fiction," Eric S. Rabkin (University of Michigan); (4) "Bachelard and Foucault: Historians of Science as Literary Critics," Elinor S. Shaffer (University of East Anglia); (5) "Thomas Kuhn's History of Science and the 'New Science' of Criticism," Grant Webster (SUNY-Binghamton). Papers will be available in October (for \$1.00 each) from Walter Schatzberg (Department of

Foreign Languages, Clark University, Worcester, MA 01610).

**CONFERENCE:
ENVIRONMENTAL RESEARCH
AND POLICY**

The Environmental Design Research Association (EDRA) provides a forum for individuals interested in understanding the relationships between people and their environment and in using this understanding to improve the quality of both natural and designed environments. EDRA's Eleventh Annual Conference will be held 2-6 March 1980 at the College of Charleston (South Carolina), and the conference organizers have issued a call for papers, symposia, workshops, or poster presentations on the theme of "Optimizing Environments: Research, Practice, and Policy." Deadline for submission in all four categories of participation is 15 November 1979.

Original, heretofore unpublished papers may address any of the theoretical, research, or applied issues relevant to the conference or the concerns of the organization. All papers will be blind refereed and there are stringent specifications for format of submissions. Symposia proposals will also be refereed and must be organized around a specific theme or issue. The conference will also include workshops, informal discussions, and poster sessions. Conference co-chairpersons are Roger Stough (The College of Charleston), Abraham Wandersman (University of South Carolina), Aitken Clark (Clemson University), and Harlan E. McClure (Clemson University). For more information, write or call Stephanie Sanders, The

Center for Metropolitan Affairs and Public Policy, The College of Charleston, Charleston, SC 29401; telephone (803) 792-5737.

**CONFERENCE:
INTERACTIONS OF THE
HISTORY AND PHILOSOPHY
OF SCIENCES**

The Seventh Annual Meeting of the Joint Atlantic Seminar in the History of the Physical Sciences will be held at the University of Maryland (College Park) on 18-19 April 1980. The major theme of the meeting will be "Interactions of the History and Philosophy of Science." For more information, send a self-addressed envelope to: Professor Stephen G. Brush, History Department, University of Maryland, College Park, MD 20742.

**CONFERENCE: VALUE
INQUIRY**

On 18-19 April 1980, the Department of Philosophy with the Department of Political Science of the State University of New York College of Arts and Science at Geneseo will sponsor the Fourteenth Conference on Value Inquiry, "Values in the Law." The Conference will explore problems residing in the interface of the realms of law and value. The program is to be partly historical, partly analytical and partly prospective, and papers should therefore examine: traditional theories of law and morals; contemporary legal issues; or current tendencies and prospects. Interested individuals in the academic and legal professions are invited to contribute papers concerned with the follow-

ing, as well as related issues: legal-moral aspects of economic and corporate activity; legal-moral aspects of life and health sciences; the relation between legal and moral responsibility; value questions in legal decision-making. Deadline for contributed papers is 15 November 1979. Address inquiries to: Director, 14th Conference on Value Inquiry, Philosophy Department, SUNY College at Geneseo, Geneseo, NY 14454.

**CONFERENCE:
APPLIED PHILOSOPHY**

The Second Annual Conference in Applied Philosophy, sponsored by the Department of Philosophy of Bowling Green State University, will be held 2-13 May 1980, under the theme "Action and Responsibility." The conference's first session will be devoted to theoretical papers on all aspects of action theory and will be addressed primarily to professional philosophers. The second session will focus on problems of diminished responsibility, omissions as actions, to what extent agents are responsible for the consequences of their actions, as well as related topics of applied interest in such fields as the philosophy of law, philosophy of psychology, environmental ethics and medical ethics. The audience for the applied papers will include non-academic professionals as well as philosophers. Those wishing to participate in the program should submit papers no later than 7 January 1980. Address inquiries to: Professor Michael Bradie, conference in Applied Philosophy, Department of Philosophy, Bowling Green State University, Bowling Green, OH 43403.

**CALL FOR PAPERS:
CONFERENCE ON
PHILOSOPHY, CHILDREN,
AND THE FAMILY**

The Department of Philosophy at Michigan State University, in conjunction with the Department of Family and Child Sciences, will sponsor a conference on "Philosophy, Children, and the Family" to be held 28-30 March 1980, in East Lansing. While the conference will emphasize philosophical reflection on basic theoretical and practical commitments, scholars from those fields in which family and children are of immediate concern are also invited. Papers are invited from these general areas: (1) Conceptions and justifications of the family, (2) Social and ethical issues concerning families and family members in contemporary society, (3) Conceptions and justifications of childhood, and (4) Social and ethical issues concerning children. To facilitate blind reviewing, place name and institutional affiliation on a separate page. Papers should be from 20 to 30 minutes reading time and should be submitted by 10 December 1979 to Conference on Philosophy, Children and the Family, Department of Philosophy, Michigan State University. For more information, contact Professor Albert C. Cafagna or Professor Richard T. Peterson, Department of Philosophy, Morrill Hall, Michigan State University, East Lansing, MI 48824.

**CALL FOR PAPERS: TECH-
NOLOGICAL PESSIMISM**

The editors of *Alternative Fu-*

tures invite papers of up to 7500 words that take any position or approach, and may represent any discipline, so long as they consider the general problem(s) of why and/or how technological progress has generated pessimistic response. Those selected will be published in the Spring 1980 edition. The core of the volume will be four papers to be presented in a University of Michigan symposium (31 October-2 November) by Richard Falk, Samuel Florman, Leo Marx, and Mel Kranzberg. Papers will be accepted through 15 January 1980, and should be submitted in duplicate (with return postage) to guest editors D. Stevenson and M. Barton, Department of Humanities, University of Michigan, Ann Arbor, MI 48109; telephone (313) 764-1420.

**CALL FOR PAPERS: JOURNAL
OF SOCIAL AND BIOLOGICAL
STRUCTURES**

The Journal of Social and Biological Structures, founded in January 1978, has issued a call for papers. Contents of recent issues include articles on such diverse subjects as "Altruism, Malice, and Public Goods," "Information and Biology," "Symbolic Function, Technology and Society," "Dynamic Models of Urban Growth," and "Natural Economy Versus Political Economy." Chief Editors are Harvey Wheeler (P.O. Box 704, Carpinteria, CA 93013) and James F. Danielli (Alden Memorial, Room 3, Worcester Polytechnic Institute, Worcester, MA 01609).

**FELLOWSHIPS: NATIONAL
ENDOWMENT FOR THE
HUMANITIES**

The National Endowment for the Humanities will offer fellowships for 1980-81 to teachers in undergraduate and two-year colleges who wish to participate in seminars directed by distinguished scholars at designated universities and to undertake study and research of their own choosing beyond the work of the seminar. These fellowships are open only to members of departments that do not offer the Ph.D. and carry stipends of up to \$20,000 for twelve months of tenure. 1980-81 award application deadline is 12 November 1979. Awards will be announced in mid-March 1980, and Fellows may begin tenure as early as 1 June 1980. Contact Division of Fellowships, Mail Stop 101, National Endowment for the Humanities, 806 15th Street, N.W., Washington, DC 20015.

**FELLOWSHIPS: HASTINGS
CENTER POST-DOCTORAL
PROGRAM**

Under a grant from the National Endowment for the Humanities, and the Society for Values in Higher Education through an award from the Jessie Ball DuPont Religious, Educational and Charitable Trust, the Hastings Center will provide three one-year post-doctoral fellowships for the study of ethics and the life sciences during the academic year 1980-81. The purpose of these fellowships is to permit both older and younger researchers to prepare themselves systematically for future productive research and teaching on ethical

problems arising from advances in medicine, biology, and the behavioral sciences. The fellowship year will commence 1 September 1980, and run until 31 August 1981. Final deadline for application (including supporting documentation) is 1 January 1980. The stipends are \$19,000 for one year. The stipend is expected to cover all costs, including transportation and housing. In addition, \$1,000 will be made available to cover secretarial expenses and research-related travel. Minimal requirement is an advanced doctoral or professional degree (or its equivalent). Applicants are welcome from all disciplines. United States citizenship is required. The purpose of the fellowship year is to lay an intellectual foundation for future productive scholarship and teaching in ethics and the life sciences. The Center will entertain two types of proposals, a *research* or a *study* proposal. A *research* proposal would be one in which the applicant desires to spend the fellowship year on a specific research project. A *study* proposal would be one in which the applicant proposes to spend the year carrying out a broad reading and study program, one essentially designed to provide the applicant a strong interdisciplinary base for future work in the field of ethics and the life sciences. Preference will be given to those submitting a study proposal. For more information and for application forms, write: Post-Doctoral Fellowship Program, The Hastings Center, Institute of Society, Ethics and the Life Sciences, 360 Broadway, Hastings-on-Hudson, NY 10706.

FELLOWSHIP: NEH SPONSORS WORK ON THE ANTARCTIC

The National Endowment for the Humanities is cooperating with the National Science Foundation's U.S. Antarctic Research Program in selecting a scholar in the humanities to spend one to six months in Antarctica from October 1980 to March 1981. Under the first such fellowship, awarded last year, Lawrence J. Baack, Professor of History at the University of Nebraska, is currently studying the American involvement with Antarctica since 1945.

The second Antarctic Fellowship will be awarded for a continuous period of either three, six, or twelve months of full-time study and research, with maximum stipends of \$5,000 for three months, \$10,000 for six, and \$20,000 for 12, based on the Fellow's current academic-year salary, minus sabbatical and other grants. The Fellow will be expected to spend a substantial period in the Antarctic. Travel, polar clothing, and subsistence in Antarctica will be provided by the National Science Foundation. Applications should be submitted no later than 2 January 1980.

The Antarctic Fellowship is intended for scholars whose work seems likely to lead to significant contributions to humanistic thought and knowledge. Candidates for degrees and persons seeking support for work leading toward degrees are not eligible, although applicants need not have advanced degrees to qualify. Applicants must be doing or planning to do research relating in whole or in part to Antarctica. For further information or application materials, write

to: Antarctic Fellowship, Division of Fellowships, National Endowment for the Humanities, 806 Fifteenth Street, N.W., Mail Stop 101, Washington, DC 20506, or call David Coder or Joseph Neville at (202) 724-0333.

FELLOWSHIPS: NATIONAL HUMANITIES CENTER FELLOWS

The National Humanities Center will admit approximately forty Fellows for the academic year 1980-81. The group of Fellows chosen each year includes both scholars of established reputation and young scholars of promise who have held the doctorate no more than ten years. In addition to scholars in fields traditionally identified with the humanities, the Center admits representatives of the natural and social sciences, the professions and public affairs. Scholars from outside the United States are also welcome to apply. The usual term of a fellowship is the academic year, September through May, but some fellowships are available for shorter periods. Stipends are based on the normal academic salaries of Fellows; those who have partial support in the form of sabbatical salaries or research grants receive from the Center the difference between that support and their normal salaries. Fellows also receive travel expenses to and from the Center for themselves and their families. Deadline for 1980-81 applications is 10 January 1980. For application material and information, write: National Humanities Center, P.O. Box 12256, Research Triangle Park, NC 27709.

SSIE PACKAGE ON ETHICAL ISSUES IN SCIENCE

Smithsonian Science Information Exchange (SSIE) is now offering a research project summary package on ethical issues in science. Packages CT151, "Ethical Issues in Modern Science" (\$45.00), and CT161, "Ethical Aspects of Experimentation with Human Subjects" (\$35.00), contain notices of research projects funded by Federal agencies. To order, or for a list of available packages on other subjects, write SSIE, Room 300, 1730 M Street, N.W., Washington, DC 20036. (Add 10% to cost for shipments to be mailed outside the U.S., Canada, or Mexico.)

PUBLICATION: GUIDE TO PROGRAMS AND INFORMATION ON SOLAR ENERGY

The U.S. Congressional Environmental Study Conference has published a new edition of its "Solar Energy Fact Sheet," a useful guide to federal and state programs for and sources of information on solar energy. Copies may be obtained at no cost from your local Congressman or Senator.

The Environmental Study Conference (ESC) is an informal, bipartisan legislative research organization composed of more than 300 members of the U.S. House and Senate. ESC does not serve as an advocate; rather, it provides timely and balanced analyses of environmental and energy issues to help its members in their legislative and constituent service responsibilities. Each Monday Congress is in ses-

sion, ESC publishes the *Weekly Bulletin*—a comprehensive legislative report highlighting environmental and energy bills scheduled for the floor, tracking committee action, reporting on emerging trends and monitoring the legislative implications of actions outside Congress. Supplementing the *Bulletin* are floor briefs analyzing environmental and energy bills scheduled for the floor. In addition, ESC sponsors briefings for members and their staffs; publishes in-depth fact sheets on significant issues and provides a variety of special services to its members. The *Weekly Bulletin* is available to people outside Congress on a subscription basis. For more information, write Mike McCabe, Director, Environmental Study Conference, U.S. Congress, 3334 House Annex 2, Washington, DC 20515; telephone (202) 225-2988.

PUBLICATIONS: WORKSHOPS ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

At the request of the U.S. Department of State, the American Association for the Advancement of Science organized four workshops in March, April and May 1979 on special topics in science and technology for development: (1) "Women and Development," (2) "Building National Institutions for Science and Technology in the Developing Countries," (3) "Science and Technology for Development: Organized Labor's Concerns," and (4) "The Role of Scientific and Engineering Societies in Development." Both a short *Report* and a longer *Proceedings* volume are available for each workshop,

at no charge as long as the supplies last. Write: Denise Weiner, Program Associate, Office of International Science, AAAS, 1776 Massachusetts Avenue, N.W., Washington, DC 20036.

PUBLICATIONS: NEW JOURNAL ON SOCIAL ANALYSIS

Social Analysis, a new journal published in Australia, will feature articles on critical issues and problems in the social sciences. Although the editorial policy will stress primarily anthropological or sociological articles, the journal will not exclude contributions from scholars who work in cognate disciplines (e.g., geography, economics, history, politics, psychology) or the humanities, provided contributions aim to deepen the understanding of human behavior in the political, cultural and social world of ideas and action. Special features include: no limit to the length of articles except that long articles must be of outstanding value; speedy publication; and encouragement to essays and comments from honors and postgraduate students. For more information, write: The Managing Editor, *Social Analysis*, Department of Anthropology, The University of Adelaide, GPO Box 498, Adelaide, South Australia 5001.

Bibliography

Andrews, Frank M., ed. *Scientific Productivity: The Effectiveness of Research Groups in Six Countries*. New York: Cambridge University Press, 1979. xxxiv + 469 pp.; \$24.95 (hb).

This volume reports preliminary results from a UNESCO-initiated study, the International Comparative Study on the Organization and Performance of Research Units, which collected data from 11,000 participants in 1200 research units in six European nations. The project aim was to find ways to enhance performance effectiveness of research units, and also to develop and test methods for assessing the organization and performance of such units. Papers on the assessment itself include such topics as individual publication productivity, the relationship between leadership and group performance, externally-determined resources and group effectiveness, patterns of influence, and communication within and between research units. A book that may interest science policy specialists as well as sociologists, psychologists, and research managers.

Appropriate Technology Guide. Washington, DC: Citizen's Energy Project, September 1979. 120 pp.; \$4.00.

A study prepared for the National Center on Appropriate Technology which looks at model community-level appropriate technology programs underway throughout the country. Alternative health care, housing, renewable energy, agriculture, transportation, communications, waste recycling, and other programs are

discussed, including suggestions of how to launch such programs. (Order from Citizen's Energy Project, 1110 Sixth Street, N.W., Suite 300, Washington, DC 20001.)

"Appropriate Technology: Who Decides?" *World Education Reports* 19 (May 1979).

This issue of *World Education Reports* considers appropriate technology, especially as it applies to developing Third World nations. Articles include "Small Is Of Course Beautiful, But Nobody Ever Said Small Is Easy," by Russ Dilts and Craig Thorburn and "Which Technology Will Shape the Future?" by David E. Wright and Robert E. Snow. [*World Education Reports*, 1414 Sixth Avenue, New York, NY 10019; single copy, \$1.50.]

Baram, Michael. *Regulation of Health, Safety and Environmental Quality and the Use of Cost-Benefit Analysis*. Report filed with the Administrative Conference of the United States, Washington, DC (1 March 1979).

Distributed by the Administrative Conference of the United States (ACUS) to numerous government and non-government sources, this report was the basis for the ACUS Decisional-Processes Committee recommendations for regulatory reform [see 44 *Federal Register* (6 March 1979): 12198]. Both the report and the recommendations were presented at the ACUS

plenary conference, 7-8 June 1979. [Available from David Pritzker, Esq., ACUS, 2120 L Street, N.W., Washington, DC 20037.]

Barnes, Barry, and Steven Shapin, eds. *Natural Order: Historical Studies of Scientific Culture*. Beverly Hills, CA: Sage Publications, 1979. 256 pp.; \$17.50 (hb); \$8.95 (pb).

Although the history of science has increasingly been more prepared to treat science as one of many aspects of culture, and although some important historical studies have examined the social basis of scientific knowledge and even "its intimate connection with the general social context," several factors have kept this development from being generally recognized. The editors of this volume set out to correct the oversight by compiling a collection of original essays "explicitly concerned with natural knowledge as culture, and explicitly exploring the possibilities of anthropological and sociological methods in understanding it." Essays looking at how "social experience and interest affect conceptions of the body" proceed to argue for specific links between "the body natural" and "the body politick." Essays on the rise of natural science look at such cases as theories of the earth in Britain 1660-1820, social Darwinism, non-Euclidean geometry, and psychic "science." Three essays examine the social basis of scientific controversy—the biometry-Mendelism controversy, a case in botanical classification, and "Heredity, Environment, and the Legitimation of Social Policy."

Bazelon, David L. "Risk and Responsibility." 205 *Science* (20 July 1979): 277-280.

"... [O]urs is an age of doubt and skepticism. The realist movement in law effectively stripped the judiciary of its Solomonic cloak. So, too, the public has come to realize the inherent limitations of scientific wisdom and knowledge." Judge Bazelon crisply analyzes the issues and interests at stake in current judicial considerations or risks posed by scientific or technological developments and effectively outlines the role the courts can take in

safeguarding the validity of the public decision-making process.

Berlin, Isaiah. *Concepts and Categories: Philosophical Essays*. Edited by Henry Hardy, with an introduction by Bernard Williams. New York: The Viking Press, 1979. xx + 202 pp.; \$12.95 (hb).

More widely known for his writings in political theory and the history of ideas, Isaiah Berlin has also lent his mind to the discussion of philosophical issues in the theory of knowledge. In one of the essays in this volume, "The Concept of Scientific History," he examines the idea of constructing a "science" of history. Other essays attend to "The Purpose of Philosophy," "Verification," "Logical Translation," and "Equality." The closing essay, "From Hope and Fear Set Free," asks "does knowledge always liberate?" "To be free without knowing it," Berlin writes, "may be a bitter irony, but if a man subsequently discovers that doors were open although he did not know it, he will reflect bitterly not about his lack of freedom but about his ignorance. The extent of freedom depends on opportunities of action, not on knowledge of them, although such knowledge may well be an indispensable condition for the use of freedom, and although impediments in the path to it are themselves a deprivation of freedom—of the freedom to know."

"Biotechnology and the Law: Recombinant DNA and the Control of Scientific Research." Special issue, 51 *Southern California Law Review* 6 (September 1978): 969-1554.

The articles in this issue look at technical aspects of rDNA research, the history of the debate (by Swazey, Sorenson and Wong), philosophical/social implications (articles by Carl Cohen, Robert Neville, Joseph Fletcher, Tristram Engelhardt, Liebe Cavalieri, Harlyn Halvorson, and Clifford Grobstein), regulatory aspects (Susan Wright, Peter Barton Hutt, Michael Yesley, Roger Dworkin, and Raymond Zilinskas), and on public participation (articles by Halsted Holman and Diana B. Dutton, and by

Mark Lappe and Patricia A. Martin]. Highly recommended are the articles on constitutional issues (see entry below for John A. Robertson) and on tort liability. [Copies of the issue are \$10.00 each; order from Business Manager, Southern California Law Review, Law Center, University of Southern California, Los Angeles, CA 90007.]

Bloom, Barry R. "News About Carcinogens: What's Fit to Print?" 9 *The Hastings Center Report* 4 (August 1979): 5-7.

The author addresses the implications that can be drawn from conflicting results of cancer research and how information about such results (and conflicts) is and should be communicated to the public. The Dapsone (DDS) case is used as an example of the rapid and, the author argues, perhaps irresponsible release of *all* available data on carcinogenicity testing—even that which is contradicted by other tests. Bloom charges that the National Cancer Institute, under pressure to release information, has interpreted the Freedom of Information Act "as a mandate to submit data directly from the computer to the regulatory agencies, to publish the material in the Federal Register, and to release it simultaneously to the public as well." He calls this "a truly remarkable data processing system, in which the data from animal tests are transferred to computers and thence to press releases without passing through a human brain," and points out that "data are not information" and that science does have "an obligation to reveal the limits of knowledge as well." Clearly, increased public education on risk interpretation and changes in the communications attitude may be in order, although suggestions for restrictions on release of information will undoubtedly be met by disagreement.

Bolton, Kate. "The Great Awakening of the Night: Lighting America's Streets." 23 *Landscape* 3 (1979).

An example of how technological advances affect social patterns, this article examines the ways in which street lighting at the turn of the

century altered working trends, entertainment, commercial activity, and urban imagery. Period photographs illustrate the variety of techniques used to light American streets. [Subscriptions to *Landscape* are \$12.00; available from Landscape, P.O. Box 7107, Berkeley, CA 94707.]

Bosk, Charles L. *Forgive and Remember: Managing Medical Failure*. Chicago, IL: The University of Chicago Press, 1979. x + 236 pp.; \$15.00.

For eighteen months, Bosk was a participant-observer of the surgical training program of a major hospital. During that time he looked at questions of social control and social support, and at how individual commitments, motivation, and action are sustained in the face of failure. From these observations, he draws three primary themes: (a) "how a professional group draws a boundary around itself and determines its own identity through the selection and rejection of recruits;" (b) "how superordinates attempt to control performance and how subordinates accept or avoid such controls in a professional training program;" and (c) "how a professional copes with the existential problem of the limits of his skill and of his knowledge." Various chapters attend to, for example, formal peer review in surgery, everyday methods to keep error at a minimum, the impact of failure on a subordinate's career, and the mechanism of professional self-control.

Burke, John G., and Marshall C. Eakin, eds. *Technology and Change*. San Francisco, CA: Boyd and Fraser Publishing Co., 1979.

This volume on the nature of technological development, in its historical and contemporary contexts, serves as a supplement to fifteen newspaper articles appearing this fall in the latest Courses by Newspaper series. More than sixty essays and articles by some of the best writers in the field are reprinted in a reader designed for a "first look" at a complex subject. Section introductions and brief prefaces to each essay place the subjects in context. Major sections include: "Technology on Trial," "Tech-

nology's Effects," "Conditions of Technological Development," "Sources of Technological Change," and "Retrospect and Prospect." The editors have also included a brief but solid annotated bibliography of "suggestions for further reading."

Chandrasekhar, S. "Shakespeare, Newton, and Beethoven." 2 *Science, Technology & the Humanities* 1 (Winter 1979): 1-24.

By examining the creative patterns of Shakespeare, Newton, and Beethoven, Chandrasekhar seeks to identify differences in the patterns of creativity between artists and scientists. While both Shakespeare's and Beethoven's lives exhibited periods of growth followed by periods of achievement, with the deepest and most intense work produced after long development, Newton's attention to science and mathematics was sporadic, and his greatest intellectual work was accomplished in a period of seventeen months and completed when he was 42. Chandrasekhar draws no conclusions, but raises questions about the intellectual distance between the sciences and the arts.

Chiappo, Leopoldo. "Environmental Education and the Third World." 8 *Prospects* 4 (1978): 456-465.

Taking into account the special "angle of vision of the Third World nations," author Chiappo suggests certain foundations and attitudes to environmental education which can further "environmental awareness" in these nations. Chiappo asks: "can we Latin Americans, Africans and Asians, inhabitants of the needy South, accept as valid the way of seeing and interpreting ecological facts adopted by the countries of the super-industrialized, wealthy North?" He points out that environmental education "cannot be based on fear or on deliberately induced alarm," and reminds us that types of pollution or ecological damage vary not only with climate but also with such factors as wealth and levels of industrialization. Countries attempting to deal with day-to-day hard-

ship, hunger and disease among the population do not approach preservation of rare species of wildlife from the same perspective. Chiappo is concerned with developing a "new ecological ethic" that can transcend anthropocentrism and rampant industrialism, and can reconcile the need to preserve and protect the air, water, fish, fowl and land, with the need to improve the individual's "daily environment."

Chorover, Stephan L. *From Genesis to Genocide: The Meaning of Human Nature and the Power of Behavior Control*. Cambridge, MA: The MIT Press, 1979. xiii+238 pp.; \$15.00 (hb).

Chorover believes that considering the meaning of human nature and the power of behavior control as two independent aspects of human existence overlooks "their common embeddedness in a larger conceptual, material and social context." His survey of theories of human nature and behavior control practices illustrates the interplay between meaning and power in contemporary social life. The title denotes the two poles of his inquiry—one, that the conceptual roots of modern behavior control lie buried in legends about creation of the world and the genesis of humanity, and two, the use of instruments of behavior control in the systematic murder of mental patients in Nazi Germany. Chorover treats a wide variety of subjects, such as IQ measurements for social control, drug abuse, violence and crime, and "the politics of defining, measuring, and controlling the contents of the American melting pot," all with important implications for public policy.

Compton, John. "Science, Anti-Science and Human Values." *The Key Reporter* (Winter 1978-79).

"We seem to be at a new critical stage of ambivalence concerning the scientific and technical sources of our culture, and we are surrounded by a cloud of witnesses expressing their deepest misgivings about the entire scientific and technological project of western man." Compton, a philosopher, focuses his attention on three visible witnesses—Jacques Ellul,

Lewis Mumford, and Theodore Roszak—and finds in their writings evidence of the fundamental philosophical issues inherent in the problem of assimilating science and technology into the culture. Compton argues that "we need to affirm the fundamental reality and essential worth of the scientific and technical capacities of man—our right and responsibility to intervene in nature in order to try to improve the quality of human life" and accept the "organized social institutions of an industrial society which go with these capacities." Yet we must also acknowledge our limited perspective on future effects and the "concentrations of special interest and power, in government and in industry" which may limit our ability to control such effects.

Comstock, George, *et al.* *Television and Human Behavior*. New York: Columbia University Press, 1979. 581 pp.; \$16.95 (hb), \$9.95 (pb).

As with most current work on television, this major review of the social science research on television continues the reluctance to separate discussion of the specific content (which is akin to literature) and the social effects of the technology (which transcend the characters or themes of individual programs).

Deighton, Susan, compiler *The New Criminals: A Bibliography of Computer-Related Crime*. London, England: The Institution of Electrical Engineers, 1978. \$8.50 (spiral bound).

Articulate annotations, logical classification, and citations that note the country and language of publication of periodical articles make this brief (67 entries) bibliography a useful reference work. [The Institution of Electrical Engineers is a British association, but the work is available in the U.S. through INSPEC/IEEE, Service Center, 445 Hoes Lane, Piscataway, NJ 08854.]

Deighton, Susan, compiler. *Privacy and Computers: A Bibliography*. London, England: The

Institution of Electrical Engineers, 1978. \$16.00 (spiral bound).

More than 250 references published from January 1969 to July 1978, categorized into sections treating the social, organizational, legal, and technical aspects of protecting the privacy of individuals whose vital statistics are stored on countless computers. Most references are fully annotated and citations to periodicals give country and language of publication. [IEE is a British professional organization; the bibliography is available in the U.S. from INSPEC/IEEE, Service Center, 445 Hoes Lane, Piscataway, NJ 08854.]

Diener, Edward, and Rick Crandall. *Ethics in Social and Behavioral Research*. Chicago, IL: The University of Chicago Press, 1978. x + 266 pp.; \$17.00 (hb).

This investigation of research ethics and the role of personal values in research concentrates on the social and behavioral sciences, particularly in regard to the welfare of persons or communities used as subjects. Chapters discuss "the role values play in social science research and the influence it has on society." Intended primarily for researchers in these fields.

Durbin, Paul T., ed. *Research In Philosophy and Technology*, volume 2. Greenwich, CT: Jai Press, Inc., September 1979. 425 pp.; Institutions-\$32.50, Individuals-\$16.50 (hb).

The second volume in this series features essays on philosophy and technology in an international context. The introduction is entitled "The International Cast of the Philosophy and Technology Movement." Papers are grouped in four sections: Part 1—"European Contributions," Part 2—"Conference Papers, 1976-1977," Part 3—"Historico-Philosophical Studies," and Part 4—"Review and Bibliography."

Dyson, Freeman. *Disturbing the Universe*. New

York: Harper and Row, 1979. x + 284 pp.; \$12.95 (hb).

Audacious, occasionally capricious, physicist Dyson gives us his version of growing up as a scientist in World War II, Los Alamos, the Institute at Princeton, the Cold War, the feared war, and the future. He gives us more than an autobiographical record—rather, it is a series of pungent portrayals of the intellectual life and of the conflicts of social responsibility and individual moral crisis that invaded physics labs in World War II. Dyson does not adopt the pompous self-centered tone or painful humility that ruins many autobiographies of scientists, rather he remembers (and allows the reader to share) his own amazement at winding up where he did.

"Energy: Coping With a Crisis." 18 *Columbia Journalism Review* 3 (September/October 1979): 39-44.

A group of prominent U.S. reporters and editors convened to assess current news reporting on energy. Moderator Daniel Yergin outlined the themes as: "How to figure out what the story is. How the press can inform itself. Whom to believe. How to convey information to a public that alternates between inattention and conspiracy theories. How to get reliable numbers." As one reporter pointed out, for many years energy coverage "was simply a matter of business reporting or company reporting, and was handled that way." Now the media (and the public) are recognizing that there are more complex issues. Energy reporting now must take into account changing social and economic patterns, the pace of technological innovation, international politics, and the psychological impact on people who feel helpless to change or control their situation. The article is followed by a postscript by Yergin, who gives his own assessment of the performance and the gaps of energy reporting.

"Financing Industrial R&D—Government's Share." *Science Resources Newsletter* of OECD 4 (July 1979).

This issue of the *OECD Science Resources Newsletter* summarizes the role and structure of government finance of industrial R&D in the OECD area in 1975 and in selected member countries for the period 1967-1975. [Available from the OECD Press Division, 2 rue André Pascal, 75775 Paris, Cedex 16, FRANCE.]

Friedman, Robert. "The United States v. The Progressive." 18 *Columbia Journalism Review* 2 (July/August 1977): 27-35.

For thirty years there had been no court test of the injunctive power established by the Atomic Energy Act, power that allowed the Federal government to impose prior restraint on open publication of any scientific or technical information considered to be Restricted Data. Friedman points out that disuse of the statute had not lessened its threat: "Like a Minuteman missile poised in a North Dakota wheat field, the law had been an effective deterrent, even in repose While most journalists had no inclination to divulge the inner workings of thermonuclear devices, their voluntary compliance with [the extensive information-control system established by the Act] had made it no less real." This article provides an excellent and clear synopsis of the historical/political background to the Atomic Energy Act's provisions on classified data, the present classification system, and the issues of press freedom that were involved in the attempt by *The Progressive* magazine to publish an article on the "secret" of the hydrogen bomb. As the author points out, the Atomic Energy Act, which classifies "all information falling within its broad definition of Restricted Data, regardless of its origin, at birth," actually resembles the system of prior restraint on publication that the First Amendment was established to prevent. Events in September and October 1979 have altered the course of this case but the issues, once raised, deserve more discussion by the scientific and journalistic communities. Does information on nuclear energy and nuclear weapons represent a proper and tolerable exception to this country's long history of protection of press freedom and to the intention of the drafters of the First Amendment?

Fudenberg, H. Hugh, and Vijaya L. Melnick, eds. *Biomedical Scientists and Public Policy*. New York: Plenum Press, 1979. xx + 238 pp.; \$17.95 (hb).

"... [I]n this era of increasing public awareness and involvement... and at a time when the mandatory participation of laymen in biomedical research involving human subjects has been legislated by Congress, it has become the duty of the scientific community to make itself understood. Research is becoming more complex and more interdisciplinary and as a result more difficult to explain to the taxpayers and their elected representatives..." The editors of this book have assembled fourteen essays (some previously published) intended "to communicate to both biomedical scientists and intelligent laymen the processes, social and political as well as scientific, whereby biomedical science advances, and the need for biomedical scientists to take an interest and initiative... in research on health care delivery and in related public issues before the legislative and administrative branches of government." Authors include Lewis Thomas, Theodore Cooper, LeRoy Walters, Julius Comroe, Jr., and Robert Q. Marston. Essays include "The Formulation of Health Policy" (Robert J. Schlegel), "Specialization as Scientific Advancement and Overspecialization as Social Distortion" (Donald W. Seldin), "Women in Health Care Decision Making" (Nina B. Woodside), and "The Education of Black Health Professionals" (Louis W. Sullivan).

Gallagher, Edward J. *A Thousand Thoughts on Technology and Human Values*. Bethlehem, PA: Lehigh University, Humanities Perspectives on Technology Program, 1979. 92 pp.; \$3.00 (pb).

Some people collect stamps or antiques or railroad cars or cats; E.J. Gallagher collects quotations pertaining to interaction of technology and human values. The pages of this book are packed with amusement and insight—statements range from the serious observations of scientists, engineers, social historians and philosophers to the keen social microscope of

the cartoonist or comedian. The compiler also does not neglect those statements made in advertisements, or elsewhere in popular culture, which open little windows onto public images of technology. There is a name index, but we would have found the book slightly more useful had the quotations been arranged either by broad subject area or chronologically or had there been even a brief index. [Available from the HPT Program, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015.]

Graham, Loren R. "The Multiple Connections Between Science and Ethics." 9 *The Hastings Center Report* 3 (June 1979): 35-40.

Graham agrees with Toulmin's observations [see annotation to Toulmin, Stephen, below] that "we have recently passed through a period (a generation or two) in which an extreme and historically conditioned effort was made to achieve a complete divorce between science and values..." However, Graham is "troubled" by "a striking discrepancy between the actual, historical interaction of science and ethical values during our century and the relationship which [Toulmin] described," and points to two examples of how "throughout the history of science a great many attempts have been made to draw conclusions about ethical or socio-political values on the basis of science..." Graham writes that "we have left behind the view that science is value free... We recognize the links that exist between many areas of science and our values and ethics." But we must also not refuse to see where science has been affected by values and then to both examine the history of science to see "where science-value interactions have occurred with important social effects" and "explore the ethical dimensions of present scientific research procedures and technological practices."

Greenberg, Daniel S., ed. *Science and Government Report International Almanac, 1978-79*. Washington, DC: Science & Government Report, 1979. 368 pp.; \$75.00 (hb).

Second in the *SoGR* series analyzing the political and economic organizations and events pertaining to science throughout the world. Essays on individual countries or regions look at how and by whom and on what criteria science policy is made. What are the political, economic, and cultural factors that affect science-policy making? For each nation, expenditures, allocations, major policy issues or controversies, relevant appointments and elections, and probable directions are reviewed.

Grobstein, Clifford. *A Double Image of the Double Helix: The Recombinant-DNA Debate*. San Francisco, CA: W.H. Freeman and Co.; 1979. xi + 177 pp; \$11.00 (hb), \$5.95 (pb).

The author of this slim but potent volume was involved in the public and private debate over recombinant DNA research, and he states that this book was written during much of the period it describes. "Looking back . . . , one can descry a kind of paroxysm of public concern over recombinant DNA research, beginning in 1975, rising to a climax in early 1977, and subsiding in 1978. Now that the tumult and shouting have declined, one can take a calmer look at the behavior of the body politic in the face of a profoundly important issue that briefly but strongly agitated the public mind." Grobstein looks at both the scientific and the public policy perspectives on the debate, clearly stating his own "passions and predilections" and subjective judgments. This technical book includes the details of rDNA research, analysis of the specific containment requirements and, as appendixes, the full texts of the Asilomar statement, the NIH directives and guidelines in 1976 and 1977, and the guidelines devised for research in Cambridge, Massachusetts.

Guttmacher, Sally. "Whole in Body, Mind & Spirit: Holistic Health and the Limits of Medicine." 9 *The Hastings Center Report* 2 (April 1979): 15-21

An intelligent discussion of the "holistic" approach to health and medicine, an approach in which health is regarded as "a positive state of

functioning and not just the absence of symptoms or disease." Guttmacher points out possible benefits of holistic therapeutic procedures, but she also considers the limitations of holistic concepts. For example, by over-emphasizing personal responsibility for health, holistic medicine may distract attention from potentially correctable social and economic conditions which influence the occurrence and severity of disease. Guttmacher warns that, in incorporating concepts of holistic medicine, we must not ignore or underemphasize "the social, the preventative, and the deeper roots of health and disease."

Holton, Gerald, and Robert S. Morison, eds. *Limits of Scientific Inquiry*. New York: W.W. Norton and Company, 1979. xviii + 254 pp.; \$15.00 (hb).

In this book version of the influential *Daedalus* volume, a banquet of writers examines the ethical, political, social, and ideological issues in limits on the subjects, methods or motives of scientific research. In a new social/political climate that is cognizant of the risks posed by science and technology and yet impatient for spectacular benefits and quick fixes to complex problems (and also willing to affix blame), there is a need for calm attention by the scientific and technical communities to the implications of this climate for the character and future of scientific research. Authors include: Loren Graham, Robert L. Sinsheimer, David Baltimore, Lynn White, Jr., Leo Marx, Don K. Price, Walter P. Metzger, Sissela Bok, Judith P. Swazey, Barbara J. Culliton, Peter Barton Hutt, Harvey Brooks, Dorothy Nelkin, and Robert Morison. An essay by Gerald Holton, "From the Endless Frontier to the Ideology of Limits," places the discussions in the context of changing visions, changing conceptions of science: "We have in fact entered a period where old and new theories of progress in science are vigorously competing—in the mind of the public, among those engaged in the study of nature, and among scholars who study science as an activity."

"Humanism in Science Education," a report on

the United States-Japan Conference on Science Education, April 1979. Washington, DC: The National Science Teachers Association, 1979. 29 pp.

Transcript of a one-day conference held at the National Academy of Sciences on 2 April 1979, and co-sponsored by the National Science Teachers Association (NSTA) and the SONY Foundation of Science Education (See *STHV* Issue #28, Summer 1979, for a report on this meeting.) Available from NSTA, 1742 Connecticut Avenue, N.W., Washington, DC 20009.

"Innovation and the Governance of Technological Change," papers by Paul Grant and Stuart Macdonald, Occasional Papers No. 3. Queensland, Australia: Science Policy Research Centre, School of Science, Griffith University, March 1979. 65 pp.; \$2.00 Australian (pb).

The paper by Grant, "Governments and Technological Innovation," draws comparisons between Australia and other developed countries in their efforts to foster innovation. Grant believes that "government's proper role is to provide the supportive infrastructure and industrial climate which will foster industrial innovation by private enterprise, not create new agencies to undertake commercial development of new technology as surrogate companies." He argues that the latter course would likely "emasculate the innovative skills of industry, blind government to the need to remove existing disincentives for innovation, and belittle the incremental (but, in aggregate, substantial) advances in productivity available from the adaptation of industrial techniques originated by others." The paper contains a substantial reference list.

The second paper—"The Governance of Technological Change in Australia" by Stuart Macdonald—attends to that specific part of science policy in which governments "take it upon themselves to exert what direction and control they can over technology." Macdonald's incisive and serious analysis teaches us through clear statement and many appropriate metaphors. We can't resist quoting a few: "R&D, because it is seen as the key to increas-

ing man's ability, is, like motherhood and giving to charity, generally regarded as a good thing," "It seems odd that our society recognizes the link between artistic creativity and nonconformity and yet expects technological creativity to emanate from white-coated men working in designated research laboratories between the hours of nine and five," "In Australia, the only significant source of long-term finance for small business is the bank overdraft." But Macdonald's keen sense of social humor is only the seasoning in an instructive, serious article that teaches about more than the attitudes of one government toward the regulation of technological innovation. [Available from the Science Policy Research Centre, School of Science, Griffith University, Nathan, Brisbane, Queensland 4111, Australia.]

Jackson, David A., and Stephen P. Stich, eds. *The Recombinant DNA Debate*. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1979. xiv + 385 pp.; \$19.95 (hb).

The first campus to be engulfed in significant controversy over recombinant DNA research was the University of Michigan at Ann Arbor. The public debate and a special open forum aimed at communication to the surrounding community led these editors to assemble a "source book laying out the many sides of the debate and the scientific background needed to evaluate the issues intelligently." Three opening essays (by D. Jackson, A.M. Chakrabarty, and Roy Curtis III) set out the scientific background. (The editors say that these would be "accessible to a reader with a high school background in biology and chemistry," but that seems an underestimation of the difficulty of the material.) A lengthy introduction outlines the history of the public debate at Michigan. Part II includes essays by scientists "For the Opposition" (Robert L. Sinsheimer, George Wald, and a Science for the People collective) and "For the Defense" (Bernard Davis, Rolf Freter, and Joshua Lederberg) [N.B., these are the characterizations used in the book]. In the final section, authors look at the philosophical issues (Stephen Stich), the legal aspects (Carl Cohen, Roger B. Dworkin), how shifts in funding affect scientific decision-making (Max Heirich),

socio-political factors in "Who Decides Who Decides . . ." (Donald N. Michael), and an intriguing analysis by a journalist of "The Press as Guilty Bystander" (Charles R. Eisendrath).

Kardestuncer, Hayrettin, ed. *Social Consequences of Engineering*. San Francisco, CA: Boyd and Fraser, 1979. 304 pp.; \$16.00(hb), \$9.95(pb).

Intended as a reader for courses in engineering or professional ethics, this book examines a wide range of topics on the interaction of engineering and society. Chapters include "Energy and Society" (Ali B. Cambel), "Pollution" (P.A. Vesilind), "Genetic Engineering" (Amitai Etzioni), and "Controlling Engineering Democratically" (Arthur Kantrowitz).

Kelly, Alison. *Girls and Science: an International Study of Sex Differences in School Science Achievement*. Stockholm, Sweden: Almqvist and Wiksell, 1978. 152 pp. Swedish Kr. 66.50 (pb).

Analysis of the sex differences in the performance of 14-year-old children from 14 countries, on achievement tests in biology, chemistry, physics and practical science. See review in *Science* (20 April 1979): 295-296.

Kevles, Daniel J. "The Health of Science." 259 *Harper's* 1551 (August 1979): 26-31.

Historian Kevles outlines for a lay audience the discussion of whether or not American science is in "decline." He attributes some of the scientists' "distress" to the fact that "science in America, at last recognized as a powerful interest group, has entered an era of rigorous democratic scrutiny and control." He argues that scientists might increase their awareness of the place of science in a changing economy, might "proceed with caution" and reassess the organization of research, and "might also begin to debate the practical issue of quality in science."

Klein, Judy. "The Medium Gets A Message." 115 *Science News* 22 (2 June 1979): 361, 365.

There is a growing interest among producers in expanding the number of science programs on television. After examining some of the reasons why science programs have had limited success in the past, this article reviews several new or currently popular television series dealing with science (including "NOVA" [WGBH-TV, Boston], "Synthesis" [KPBS-TV, San Diego], and these upcoming series: CBS "Universe," Carl Sagan's "Cosmos," and the Children's Television Network's science and technology series for 8-to-12-year-olds.

Knuth, Donald E. "Mathematical Typography." 1 *Bulletin (New Series) of the American Mathematical Society* 2 (March 1979): 337-372.

An entrancing article by one of the leaders in computing. Knuth has long been interested in the intricacies of publishing. In this paper, delivered as the AMS J.W. Gibbs Lecture in 1978, he talks about "typography as the servant of mathematics" (and as an aid to clearer communication) and about "mathematics as the servant of typography" (here describing, in beautifully-composed detail, the link between mathematics and the art of type design). His accounts of how particular design problems were solved by fifteenth- and sixteenth-century calligraphers and mathematicians are particularly instructive.

Ladd, John, ed. *Ethical Issues Relating to Life and Death*. New York: Oxford University Press, 1979. x + 214 pp.; \$12.95 (hb), \$6.95 (pb).

The papers forming the core of this book were presented at a conference (Brown University, February 1974) devoted to exploring philosophical problems raised by recent advances in medical science and technology. Extensive revision, and the addition of several other good essays, raise this book above the normal level of conference proceedings. These are sensitive philosophical appraisals from varied perspectives on

the difficult subject of what is commonly called "euthanasia," a word that originally was used to denote a "good, quiet and gentle death" and is now applied to the action of another party aimed at bringing about or permitting a person's death. Ladd, in his introduction, shows that certain distinctions must now be discussed—voluntary or involuntary, active or passive, direct or indirect?—and none are easy. Essays include "Euthanasia" (Philippa Foot), "Unsanctifying Life" (Peter Singer), "Decisions to Terminate Life and the Concept of Person" (Michael Tooley), "Moral Rights and Permissible Killing" (Dan Brock), "The Definition of Death and the Right to Die" (John Ladd), "Euthanasia, Killing and Letting Die" (James Rachels), "Positive and Negative Euthanasia" (John Ladd), and "Social Perspectives on Medical Decisions Relating to Life and Death" (Raymond Duff and A.G.M. Campbell).

Lefever, Ernest W. *Nuclear Arms in the Third World: U.S. Policy Dilemma*. Washington, D.C.: Brookings Institution, 1979, 155 pp.; \$9.95 (hb), \$3.95 (pb).

Nuclear power plants provide the materials and technical facilities necessary to produce nuclear weapons. Having encouraged and supported Third World countries in their development of such generating facilities, the U.S. now finds itself trying to impose physical and legal safeguards to prevent these countries from using nuclear technology for weapons. Despite U.S. objections, and despite the costs and political risk, several Third World states are likely to produce nuclear arms, because they fear abandonment by a nuclear ally. Lefever argues that the most effective course to prevent the spread of nuclear weapons is to strengthen U.S. security commitments to friendly or allied states. His study examines the possibility of nuclear acquisition in nine states: India, Pakistan, Iran, Israel, Egypt, South Korea, Taiwan, Argentina, and Brazil. [Order from Brookings, 1775 Massachusetts Ave., N.W., Washington, DC 20036; in Canada, from McGill-Queen's University Press.]

Littlewood, J.E. "The Mathematician's Art of Work." 1 *The Mathematical Intelligencer* 2 (1978): 112-118.

Track it down and read it. If you don't find it useful or entertaining or a psychological lift, then you'll probably know someone who will. Littlewood's banquet of observation on the process of mathematical creativity will nourish researchers or practitioners in other disciplines as well. His observations on creativity, research strategy, and the value of breaks should be required reading for every new (and old) graduate student. [*The Mathematical Intelligencer* is a new quarterly journal published by Springer-Verlag.]

Lundgren, Lars, Birgitta Oden, and Sverker Oredsson. "The Use of Nature As Politics." 3 *Environmental Review* 2 (Winter 1979): 20-51.

This article first reviews how different disciplines (e.g., geography, history, sociology) have dealt with the relationship of man and environment, and then discusses the methodological problems in environmental history. The authors then look at the use of intensive, short-term studies to pinpoint "relevant factors" in conflicts over nature as environment and as a resource. The concluding section deals with political and social decision-making.

Lunin, Lois F., ed. *Health Sciences and Services: A Guide to Information Sources*. Detroit, MI: Gale Research Co., 1979. xxx + 614 pp.; \$24.00 (hb).

An annotated handbook to major publications and information facilities within all disciplines in the health sciences, from public health to health science research to the pharmaceutical industry. The entries describe abstracting and indexing services, periodicals, bibliographies, guides, data bases, and relevant organizations.

Malina, Frank J., ed. *Visual Art, Mathematics and Computers*. Oxford, England: Pergamon Press, 1979. 320 pp.; \$50.00 (hb).

Fifty-three selections from the past ten years of the journal *Leonardo*, edited by the journal's founder Frank Malina. The book "reveals how modern art forms have adapted to present-day progress in science and technology." Contributors include artists concerned with visual expression of mathematics or execution of works by or with the aid of advanced technologies, and specialists in the relevant technical fields.

Manuel, Frank E., and Fritz P. Manuel. *Utopian Thought in the Western World*. Cambridge, MA: Harvard University Press, 1979.

A major anatomy of utopian thought, from More to Marcuse. The authors identify "successive constellations of utopias," within which they analyze individual writings seen in their social, political, economic or religious context.

Marwell, Gerald, Rachel Rosenfeld, and Seymour Spilerman. "Geographic Constraints on Women's Careers in Academia." 205 *Science* (21 September 1979): 1225-1231.

Social research on the residence patterns of male and female academics show that women are more likely to settle in large metropolitan areas and less likely to move between geographic locales when changing jobs, thus suggesting a structural source for some of the disparity between the career advancement of males and females in academia.

Mettler, Fred, Charles Kelsey, and Michael Baram. "Medical and Legal Implications of a Large Release of Radioiodine." 19 *Nuclear Safety* 6 (November-December 1978).

The release of radioiodine following a nuclear accident would require the immediate implementation of certain emergency plans to les-

sen the effects of radiation on the exposed population. Published almost six months before the Harrisburg incident, this paper called for evacuation plans and for the storage of medical supplies of potassium iodide, which could be administered to those exposed to the radiation—especially children—to block their intake of radioiodine.

Mitchell, Ferd H., and Cheryl C. Mitchell. "Social Impact Assessment for Health Care Programs: Steps Toward a Research Protocol." *Social Impact Assessment* 40/41 (April-May 1979): 3-6.

The authors look at problems in forecasting future resource needs for health care systems, and in assessing the future social impact of either stable or changed systems. They note that previous attempts applying other techniques have had poor results, perhaps because easy variables such as dollars, patient volume, and number of beds inadequately describe the health care system. They suggest that new variables—such as "political power"—may need to be developed.

National Research Council. Commission on Human Resources. *Career Patterns of Doctoral Scientists and Engineers, 1973-1977: An Analytical Study Prepared for the National Science Foundation*. Washington, DC: National Academy of Sciences, 1979. 88pp.

A report on data from the NAS continuing Survey of Doctorate Recipients. [Available at no cost from the Commission on Human Resources, NRC, NAS, 2101 Constitution Avenue, N.W., Washington, DC 20418.]

National Research Council. Committee on Environmental Research and Development, Environmental Study Board, Commission on Natural Resources. "Report to the Director, Office of Science and Technology Policy, Executive Office of the President." (31 May 1979); 14 pp.

This committee report proposes criteria for the Federal Government to use in determining

environmental research and development priorities. The committee observed that: "As a consequence of the fragmentation of environmental research programs, information has not always been available on a timely basis to support decision making, there is little coordination among programs or objectives, and there is little reason to believe that the most important programs are necessarily receiving the highest priority and resource allocation." Three criteria are proposed: The "importance or severity of the environmental problem under consideration," the "extent to which research and development can eliminate uncertainties and clarify issues," and the "extent to which the results of research and development will have a significant effect on environmental decisions." [Available at no cost from the Environmental Studies Board, NRC, NAS, 2101 Constitution Avenue, N.W., Washington, DC 20418; supply limited.]

National Research Council. Committee on the Assessment of Polychlorinated Biphenyls in the Environment, Environmental Studies Board, Commission on Natural Resources. *Polychlorinated Biphenyls*. Washington, DC: National Academy of Sciences, 1979. 196 pp.; \$7.25 (pb).

Prepared in response to a request from the Environmental Protection Agency, this report assesses the effectiveness of current and proposed guidelines for evaluating the hazards of PCBs, and extends this analysis to hazards that may be posed by other chemicals. The NRC Committee stated that, if PCBs were considered today for U.S. manufacture and use, "most of the health hazards associated with nonoccupational exposure to PCBs probably would not be detected" by the EPA's two principal testing schemes. [Available from NAS, Office of Publications, 2101 Constitution Avenue, N.W., Washington, DC 20418, ISBN 0-309-02885-X].

National Research Council. Committee on the Education and Employment of Women in Science and Engineering, Commission on Human Resources. *Climbing the Academic Ladder*:

Doctoral Women Scientists in Academe. Washington, DC: National Academy of Sciences, 1979. xv+155 pp.; \$8.00 (pb).

A report on the status of women scientists in academic institutions, which examines the current situation in postdoctoral training and the role of women in national science advisory bodies. [Available from the Office of Publications, NAS, 2101 Constitution Avenue, N.W., Washington, DC 20418; ISBN 0-309-02880-9.]

National Research Council, and National Academy of Sciences. *Medical Technology and the Health Care System: A Study of the Diffusion of Equipment-Embodied Technology*. Washington, DC: National Academy of Sciences, 1979. 314 pp.; \$10.75 (pb).

Findings and recommendations of a recent joint study by the Committee on Technology and Health Care, Assembly of Engineering, National Research Council and the Institute of Medicine, National Academy of Sciences, of the costs and effectiveness of processes by which new medical equipment and related technologies are adopted and used in health care. The report indicates that certain methods of payment for health care (1) are biased towards the use of new medical technologies without sufficient regard for their cost or effectiveness, and (2) discourage the sharing of equipment-dependent technologies among institutions.

Nelkin, Dorothy, ed. *Controversy: Politics of Technical Decisions*. Beverly Hills, CA: Sage Publications, Inc., 1979. 288 pp.; \$16.00 (hbk), \$7.95 (pb).

In the heat of controversies or disputes, many of the heretofore hidden (or neglected) concerns, public attitudes and assumptions, and special interests boil to the top. In Nelkin's book, the authors examine the process of boiling, as well as substances revealed, in twelve contemporary public controversies involving technology. Nelkin's introduction points out that, in all these cases, the challenge to the scientific and technical communities may be less that of pub-

lic disapproval than of the "increasing politicization of science and technology." The case studies were selected "to suggest the variety of political, economic, and ethical issues that provoke public debate." Some of the cases (and authors) include: the Toronto Airport controversy (Jerome Milch), Soviet environmental disputes (Thane Gustafson), nuclear waste disposal (Susan Brown), laetrile (James Peterson and Gerald Markle), fetal research (Steven Maynard-Moody), and rDNA research regulation (Sheldon Krinsky). Highly recommended is Nelkin's general essay on "Science, Technology, and Political Conflict: Analyzing the Issues."

Numbers, Ronald L. "William Beaumont and the Ethics of Human Experimentation." 12 *Journal of the History of Biology* 1 (Spring 1979): 113-135.

The author places in historical perspective the career and ethical principles of William Beaumont, a nineteenth-century physician known for his physiological experiments on a gastric fistula patient. Beaumont's accounts of his "motives of charity" are compared to evidence of attitudes that seemed to ignore the rights and personal preferences (or comfort) of the patient. Numbers writes that "some evidence suggests that Beaumont was not unaware of the ethical implications of his actions," but reports that, by and large, the medical community and medical press condoned and often praised Beaumont's work. Beaumont was "a man plagued by mixed motives: to benefit himself, to benefit science, and to benefit his subject," but the author finds "little grounds for concluding that Beaumont significantly altered the course of bioethics."

Nunn, Clyde Z. "Readership and Coverage of Science and Technology in Newspapers." 56 *Journalism Quarterly* 1 (Spring 1979): 27-30.

This secondary analysis of 1971 and 1977 surveys of newspaper content and readers states that reader interest in science and technology is growing. "The problems for newspaper editors appear to be a matter of underestimating public

interest in science rather than poor judgment about what kinds of science items would appeal to readers."

Organisation for Economic Co-operation and Development (OECD). *The State of the Environment in OECD Member Countries*. Paris, France: OECD, 1979. 176 pp.; \$10.00.

This international report on the state of the environment traces changes in environmental quality in OECD member countries during the past ten years. It reviews economic pressures on the environment, examines the responses of the public, industry, and government, and assesses success and failure in protecting water, land, air, wildlife, and in handling chemical substances and noise. [Order from OECD Publications and Information Center, Suite 1207, 1750 Pennsylvania Avenue, N.W., Washington, DC 20006. Elsewhere, write OECD for the address of the nearest sales agent—OECD Publications Office, 2 rue André Pascal, 75775 Paris, Cedex 16, France.]

Organisation for Economic Co-operation and Development (OECD). *Transborder Data Flows and the Protection of Privacy*, Volume 1 in OECD Series on Information and Communications Policies. Paris: OECD, 1979. 335 pp.; \$20.00.

This report on an OECD Symposium held in Vienna, September 1977, contains the formal papers or statements by speakers and participants. English and French papers are given in the original language, with translated summaries. [ISBN 92-64-01926-X, available from OECD sales agents (see previous entry).]

Organisation for Economic Co-operation and Development (OECD). *Trends in Industrial R&D in Selected OECD Member Countries 1967-1975*. Paris, France: OECD, 1979. 200 pp.; \$11.00.

A survey of both private sector and government

R&D expenditures for high, medium, and low technology industries in eleven countries which together account for 97% of all OECD industrial R&D—U.S., Japan, Germany, the United Kingdom, and France (87% combined), and Italy, the Netherlands, Sweden, Canada, Belgium and Switzerland (10% combined). [Available from OECD sales agents (see previous entry).]

Organisation for Economic Cooperation and Development (OECD). *The Usage of International Data Networks in Europe*. Volume II in OECD series on Information, Computer, and Communications Policies. Paris: OECD, 1979. 287 pp.; \$20.00.

This report contains the results of a survey of thirty private and public data networks in Western countries. Volume III in this series will examine the policy implications of data networks. [ISBN 92-64-11861-6, available from OECD sales agents (see previous entry).]

Pechman, Joseph A., ed. *Setting National Priorities: The 1980 Budget*. Washington, DC: The Brookings Institution, 1979; xii + 229 pp.; \$11.95 (hbl), \$4.95 (pb).

After overviews of the 1980 budget and budget overlook, the contributors to this Brookings economic analysis turn to separate administration policies. In "Controlling Inflation," Daniel J.B. Mitchell examines Federal efforts such as direct intervention in wage-price levels, and "government regulatory activities and inflation." Henry Aaron looks at the domestic budget, again including attention to regulatory activities. There is also a major analysis of the 1980 defense budget. [Available from the Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036.]

Periodicals of Public Interest Organizations—A Citizens Guide. Washington, DC: Commission for the Advancement of Public Interest Organizations, June 1979. Public Interest

Groups—\$4.00; Individuals, Government, Schools and Public Libraries—\$5.00; Others—\$15.00.

A guide to over one hundred newspapers, newsletters, magazines and journals published by national public interest/citizen action organizations concerned with a variety of issues (agriculture, health, housing, taxes, consumer affairs, environment, civil liberties, etc.) Each annotation includes the name, address, and telephone number of the publishing organization, a statement of its purpose, a photograph of the periodical, its format, size, and frequency of publication, and the cost of a year's subscription. [Available from the Commission, 1875 Connecticut Ave., NW, #1013, Washington, DC 20009].

Popovsky, Mark. *Manipulated Science*. New York: Random House, 1979.

A Soviet science journalist, who emigrated to the U.S. in 1977, writes about the science establishment in the Soviet Union, and the picture is by no means favorable. See "Emigré Paints Grim Picture of Soviet Science," 205 *Science* (7 September 1979): 981-984, for a review of Popovsky's book and career.

Population Dose and Health Impact of the Accident at the Three-Mile Island Nuclear Station. Washington, DC: U.S. Government Printing Office, 1979. 99 pp.; \$3.75.

This publication outlines the findings of an Ad Hoc Population Dose Assessment Group—including information on the collective radiation dose received by the approximately two million people who live within 50 miles of the TMI Nuclear Station. The report addresses several areas of concern about the type of radiation, the degree of coverage afforded by available radiation measurements, and the range of health effects that may result from the estimated collective dose. [Stock number 017-001-00408-1.]

A Reference List of Audiovisual Materials Produced by the United States Government. 1978. Washington, DC: U.S. Government Printing Office, 1978. 396 pp.; \$5.75 (pb).

The *Reference List* compiles, by title and subject, over 6000 audiovisual materials produced by 175 Federal agencies and available to the public through the National Audiovisual Center. Materials include motion pictures, slide sets, video formats, audiotapes and multimedia kits; complete ordering information and price list are included. Major subject headings include: science, environmental sciences, social sciences, and medical sciences. [Stock number 052-003-00497-6].

Robertson, John A. "The Scientist's Right to Research: A Constitutional Analysis." 51 *Southern California Law Review* 6 (September 1978): 1203-1279.

Is there constitutional protection of freedom of scientific inquiry? Is such a freedom a right or a privilege? When, if ever, may government restrict scientific research goals or methods? In this article, Robertson aims "to establish the constitutional basis of a scientist's right to research, and the corresponding limits on state restrictions on research." He argues for First Amendment protection on grounds that grant scientists significant, but not absolute, autonomy in choice of topics and methods. Society has "overriding interest" in the consequences and, hence, the directions or routes of science, but the state does not have an overwhelming right to control it. "... [S]tate regulation of research should satisfy the exacting scrutiny required for other state limitations on information flow. Although research itself is not publication, it is an essential precondition for publication." Restriction of research because of its results, therefore, "must meet the strict standards of prior restraint and incitement," while restriction of research methods is like "restricting the manner of speech." Therefore, "the state may not ordinarily penalize scientists for what they seek to know, but only for how they seek to know it, and then only when strict standards that minimize the intrusion on

research are met." Robertson does not ignore the special conditions of modern scientific life, however, as he discusses the "power of the purse" and other ways in which research that is state-supported may indeed be subject to restriction. He admonishes scientists that the First Amendment right to research "is no help to the scientist who wants both government funds and total discretion on how to use them." An incisive and extensive analysis of this subject. [See entry for "Biotechnology and the Law," above, for more information.]

Rousseau, G.S. "Literature and Science: The State of the Field." 69 *Isis* 249 (1978): 583-591.

Rousseau traces Literature and Science (or Science and Literature) as a legitimate field of scholastic endeavor over the past thirty years—from traditionalists (who focused on the frequency of scientific references in literature without investigating them thoroughly), to theoreticians (who analyzed scientific material to integrate knowledge about the influence of science on literature), to structuralists (whose subjective methodology alienated many scholars and brought about a decline in the field). Rousseau's final comment is that today's critical pluralism "has deflected students from literature and science because it is not a valid field of study for most of the currently popular critical approaches."

Russell, Louise B. *Technology In Hospitals: Medical Advances and Their Diffusion*. Washington, DC: The Brookings Institution, 1979. 180 pp.; \$11.95 (hb), \$4.95 (pb).

While medical technology is implicated as a cause of rising medical costs, it is only part of the problem. "The real reason for rising costs," according to Russell, "... has to do with the growth of private health insurance and public programs, like Medicare and Medicaid." Russell relates the growth of seven medical technologies to various characteristics of the hospital and its market and concludes that costs will be restrained only if spending—for both medical care and medical technology—is re-

strained. [Order from Brookings, 1775 Massachusetts Ave., NW, Washington, DC 20036; in Canada from McGill-Queen's University Press.]

Ryan, Michael. "Attitudes of Scientists and Journalists toward Media Coverage of Science News." 56 *Journalism Quarterly* 1 (Spring 1979): 18-26.

A co-orientation research study of the attitudes of scientists and science writers or editors reveals that these groups share many attitudes, although they disagree on the idea that journalists' stories should be read by quoted scientists *before* publication, and that scientific research results should be released to the press only *after* publication in a scholarly journal. Although the attitudes were in most instances "remarkably similar," each group perceived the gap to be larger than it was.

Sandman, Peter M., and Mary Paden. "At Three Mile Island." 18 *Columbia Journalism Review* (July/August 1979): 43-58.

The authors take a long, hard look at how well the reporters "performed" during the crisis at the Three Mile Island Nuclear Station. They observed the journalists first-hand, sat in on press conferences, and "de-briefed" the participants later. More important, they analysed both sides of the situation—not only through review of the news stories but also by examining how the information was presented by Metropolitan Edison, the NRC, and state officials. Several factors converged to make the coverage of the nuclear accident difficult, including a barrage of highly technical information and conflicting reports from those representing the government and the utility corporation. These factors often kept reporters from focusing on an issue of major concern: the "experts," from both Metropolitan Edison and NRC, had never before dealt with a nuclear problem of this type or magnitude and did not know how to correct it. The article concludes that, on the whole, despite the confusion and the contradictions

with which they were confronted, the media did report the incident fairly creditably.

Shapley, Willis H., and Don I. Phillips. *Research and Development, AAAS Report IV: Federal Budget FY 1980*. Washington, DC: American Association for the Advancement of Science, 1979. xviii + 141 pp.; \$6.50 (pb).

Fourth in the annual series of AAAS reports, this volume includes special analyses of R&D in industry (both economic and policy aspects). On international aspects, it attends to such issues of concern as security and the world economy and to the sensitive areas of trade agreements, dependence on foreign oil, and aid to developing countries.

Sheleff, Leon. *The Bystander*. Lexington, MA: D.C. Heath/Lexington Books, 1979; 217 pp.; \$17.00 (hb).

"The varying ways in which societies organize themselves—in law and education, in declared intent and practical policy—with respect to the problem of the innocent bystander are a consequence of the way each society feels about some of its most cherished values." During the past decade, a number of academic studies have provided data on three distinct categories of the "unconcerned bystander" question: (a) the actual behavior of the bystander, (b) the bystander's legal position, and (c) the various social, moral, and philosophical issues. In this fascinating volume, Sheleff pulls together from many disciplines the research and thinking on these three perspectives, adding relevant historical and cultural information on the full range of bystander situations, from an individual cry for help to the concerted plea of a nation.

Social Science and Institutional Change. Washington, DC: U.S. Government Printing Office, 1979. 202 pp.; \$3.00.

An analysis of the application of social science theory and research to programs of institutional change in efforts to meet basic mental and

health needs to accomplish reform in correctional practices, and to make educational systems more responsive to a diverse constituency.

"Sources in Energy History: Nuclear Regulation and Licensing." *Energy History Report* (July 1979).

A brief but useful bibliographical essay on sources in the history of nuclear regulation and licensing. *Energy History Report* is available, without cost, from the U.S. Department of Energy, Historian's Office; [Energy History Report, 7G-033 Forrestal Building, Department of Energy, Washington, DC 20585].

Staats, Elmer B. "Federal Research Grants." 205 *Science* (6 July 1979): 18-20.

How to reconcile public accountability and scientific research freedom? Recognition of growing tension between the Federal government and the academic research community has led many administrators and government officials to worry through the problems caused by the need for carefully monitored accountability for public funds used to support university basic research. Many scientists view autonomy as an essential for scientific excellence, yet public funds must be accounted for. "Public pressure for fiscal accountability for university research is especially called for since the public understands little of what the research actually entails." Staats, the U.S. Comptroller General, calls for Congressional consideration of longer-term planning for research funding, including multi-year funding, and discusses reductions in time-consuming administrative procedures. He also writes that "... it might be helpful for university associations and professional societies to promote greater public understanding of the nature and importance of scientific research, and of the central role of autonomy in its confirmed excellence."

Stent, Gunther S. *Paradoxes of Progress*. San

Francisco, CA: W.H. Freeman and Co., 1978. 231 pp.; \$13.00 (hb), \$6.95 (pb).

In this collection of eleven essays, biologist Stent reflects on his belief that "progress . . . , to which science has contributed so heavily, is now nearing its end," and draws the reader's attention to "several internal contradictions—psychological, material, and cognitive—that render progress self-limiting." He also looks at some of the problems posed by the sociology of science, the nature of scientific and artistic creativity, and the relation of science to ethics—for example, Watson's "behind-the-scenes" revelations in *The Double Helix*, and "prematurity and uniqueness in scientific discovery."

Strickland, Stephen P. *Research and the Health of Americans: Improving the Policy Process*. Lexington, MA: D.C. Heath/Lexington Books, 1978. xxiii + 163 pp.; \$16.00 (hb).

"The ultimate policy goal, and the fundamental desire of medical scientists, is the reduction of disease and the enhancement of health. But are our current scientific priorities the right ones?" This book focuses on "the various decision-making processes which influence . . . medical research activities," asking how they have performed in the past and if they will be adequate for future needs. Specific sections look at health research organizations and budgets, the political and scientific bases for research priorities, peer review, some specific cases such as environmental hazards or advanced medical technology, the impact of government, ethical problems, and the connections between medical research and clinical practice. Finally, the author outlines some new ideas for priorities, processes, and strategies in health research policy.

Tarr, Joel A., ed. "The City and Technology." Special issue of the *Journal of Urban History* (May 1979). 131 pp.; \$5.00—individuals, \$8.50—institutions.

Focusing on what the contributors have called the "city-technology nexus," these essays are

concerned with four specific technologies in an urban setting: automobiles, energy systems (including electricity and gas), sewers, and street paving. They emphasize various dimensions of the relationship between cities and technology, and at the same time are concerned with the impact of technology, and human and institutional responses to that impact.

Topper, David R. "Jacob Bronowski: A Sketch of His Natural Philosophy." 12 *Leonardo* 1 (Winter 1979): 51-53.

Topper, an art and science historian, sketches out the themes of Bronowski's philosophy: that "the fundamental concepts of science were not too esoteric to be understood by an average person;" that the scientific enterprise "involves basic human values;" that scientific progress is open-ended; that scientific endeavor is creative and thus akin to the arts; and that "the uniqueness of humans lies in their imaginations, a faculty brought into play by both scientists and artists."

Toulmin, Stephen. "Can Science and Ethics Be Reconnected?" 9 *The Hastings Center Report* 3 (June 1979): 27-34.

Toulmin's "partly historical and partly diagnostic" article argues for the need to renegotiate the connection between science and ethics, recognizing that such connection should not seek to revive "outworn styles of natural theology," should not insist that ethical significance be perceived in all of science, should not be viewed as threatening (or justifying) attacks on "the proper autonomy of scientists," should not lead to doubt of the "virtues, duties, and obligations of the scientific role or station." Nor does Toulmin perceive the connections as hard and fast and identical for all aspects of science—he notes, for example, the range of scientific concepts from the "effectively 'value-free' to the irretrievably 'value-laden,'" and demonstrates how science has "divorced" ethics from science, by working "to keep ethical considerations and preferences from operating within 'the foundations of science'."

U.S. Patent and Trademark Office. *Technology Assessment and Forecast*. Washington, DC: U.S. Government Printing Office, 1979. 186 pp.; \$4.00.

The U.S. Patent and Trademark Office maintains one of the largest collections of technological literature in the world—the classified patent search file, which contains 23 million technological documents. This report outlines "the wide variety of uses to which patent information can be put and examines patent activity from a statistical and substantive standpoint." [Stock Number 003-004-00559-9.]

van Brakel, J. *Chemical Technology for Appropriate Development*. Delft, Netherlands: Delft University Press, 1978.

This 230-page work is "a report of a small research project carried out at Delft University of Technology within the department of chemical technology . . . to find out whether there exists something called 'intermediate' or 'appropriate' chemical technology" and, if so, what would be "appropriate" activities for a department of chemical technology at a university. Containing a critical review of the literature relevant to the study, the report also includes subsections on: "Choice of Production System," "Appropriate Institutions," "Appropriate Chemical Production Systems," and "Universities and Appropriate Development."

Vietor, Richard H.K. "The Evolution of Public Environmental Policy: The Case of 'Non-Significant Deterioration'." 3 *Environmental Review* 2 (Winter 1979): 3-18.

In an effort to examine the interaction of political and economic forces which have determined the course of public environmental policy, the author traces the evolution of the policy of "no-significant deterioration" (NSD) used by the Federal government. NSD refers to "the degree to which air, cleaner than the national standards mandated by the 1970 Clean Air Act, shall be further degraded by industrial pollut-

ants." In the course of a decade, the NSD concept evolved "from an ill-defined goal of 'protecting' air quality to a central premise of federal air pollution regulatory policy." The author sees this evolution "to the level of a fully articulated national policy" as a reflection of "fundamental changes in traditional American values [that] have accepted and promoted unrestrained economic growth and unfettered resource exploitation."

Wedel, Jeannette, ed. *The Role of Scientific and Engineering Societies in Development, A Summary Report*. Washington, DC: American Association for the Advancement of Science, 1979.

As part of the preparations for the UN Conference on Science and Technology for Development (UNCSTD), the AAAS sponsored a workshop on the contributions that scientific and engineering societies can make to development. This 60-page report contains a summary of the discussion and suggestions made by conference participants. [Available at no charge, while supplies last, from Denise Weiner, Program Associate, Office of International Science, AAAS, 1776 Massachusetts Avenue, N.W., Washington, DC 20036.]

Whiteside, Thomas. *The Pendulum and the Toxic Cloud: The Course of Dioxin Contamination*. New Haven, CT: Yale University Press, 1979. 205 pp.; \$15.00 (hb), \$4.95 (pb).

This book examines and questions U.S. government policy in the regulation of "2,4,5-T," an herbicide that often contains dioxin, a toxic agent known to cause fetal deformities. Disagreement and subsequent litigation (between the EPA and other environmentally concerned groups on the one hand, and the U.S. Department of Agriculture and major chemical companies on the other hand) regarding the danger of the substance are considered. The book looks at the results of the use of the substance to defoliate large tracts of land in Vietnam, and following the war, the military's subsequent difficulty in finding ways to dispose of residual supplies.

The author then documents the aftermath of an

explosion at a chemical factory in Northern Italy which released a white toxic cloud containing dioxin which settled over the communities of Medea and Seveso. After the chemical corporation's initial 9-day delay in advising residents and government health officials that the chemicals released may have contained toxic agents, the area over which the cloud had drifted was sealed off, and the residents were evacuated. The book chronicles the devastation of animals and crops, the hospitalization of citizens, the political gerrymandering that occurred in exempting part of the autostrada from the contaminated area, and the social and economic hardship suffered by the displaced citizens. A year after the disaster, the author returned to the area to reevaluate the effects of this explosion and the public's reaction to it.

Wulff, Keith M., ed. *Regulation of Scientific Inquiry: Societal Concerns With Research*, AAAS Selected Symposium 37. Boulder, CO: Westview Press, 1979. xvii + 222 pp.; \$17.00 (hb).

"The increase in regulations affecting the conduct of scientific research, and the debate about their appropriateness and effectiveness, reflect societal concerns with fundamental questions raised by certain types of scientific inquiry. This book addresses issues of ethics, accountability, and conflict as they relate to the rights of inquiry, the rights of citizens, and the role of government in a research-oriented society." Papers were presented in a symposium at the AAAS 1978 annual meeting, but the editors have also included four additional articles (by Hans Jonas, Harold Green, Gerard Piel, and Robert Sinsheimer) which enlarge or enlighten the discussion, and five papers that were originally delivered at the Congressional hearings on recombinant DNA regulations. Individual articles include "The Ethical Dilemmas of Medical Research" (Andre E. Hellegers), "Value Conflicts in Restricting Scientific Inquiry" (Barry M. Casper), "Secrecy and the Individual in Sociological Research" (Kurt W. Back), "The Constitution and Regulation on Research" (Thomas I. Emerson), "Regulations on Research as Factors of Accountability and Power" (Hans O. Mauksch), and "Privacy Regulations and Longitudinal Studies" (Lee N. Robins).

Meetings Calendar

1979

- 19-20 October** Third National Conference on Business Ethics, Bentley College, Waltham, MA. Theme: "The Work Ethic in Business." Contact: W. Michael Hoffman, Director, Center for Business Ethics, Bentley College, Waltham, MA 02154.
- 25-27 October** INTERFACE '79 — Third Annual Humanities and Technology Conference, Marietta, GA. Conference Co-Directors: Drs. Roberta Gates and George Kennedy, Department of English and History, Southern Technical Institute, Marietta, GA 30060.
- 29-31 October** Annual Conference of the Association for Computing Machinery, Plaza Hotel, Detroit, MI. Theme: "Advances of the 70's — Challenges of the 80's." Program Chairman: James L. Elshoff, Computer Science Department, General Motors Research Laboratories, Warren, MI 48090.
- 29-31 October** Association for Computing Machinery, Annual Meeting, Detroit, MI. General Chairman: Mayford L. Roark, Ford Motor Co., The American Road, Room 895 WHQ, Dearborn, MI 48121.
- 1-3 November** Conference on Business and Professional Ethics, Western Michigan University, Kalamazoo, MI. Contact: Professor Michael S. Pritchard, Department of Philosophy, Western Michigan University, Kalamazoo, MI 49008.
- 2-4 November** Third Annual Meeting, Society for the Social Studies of Science, L'Enfant Plaza Hotel, Washington, DC. Contact: Albert J. Teich, Graduate Program in Science, Technology and Public Policy, George Washington University, Washington, DC 20052.
- 8-9 November** "Albert Einstein As An Intercultural and Interdisciplinary Phenomenon: His Influence in All Fields of Thought," University Center for Cultural and Intercultural Studies (ICCIS), Hofstra University, Hempstead, NY. Conference Coordinators: Natalie Datlof and Alexej Ugrinsky, UCCIS, Hofstra University, Hempstead, NY 11550; (516) 560-3296.
- 8-9 November** Third Conference of the Center for the Study of Values, University of Delaware, Newark, DE. Theme: "Ethical Issues in Government." Contact: Professor Norman E. Bowie, Center for the Study of Values, University of Delaware, Newark, DE 19711.
- 11-13 November** Conference on Changing Values in Medicine, Statler-Hilton Hotel, New York City. Conference Co-Chairman: Eric J. Cassell, M.D., Department of Public Health, Cornell University Medical College. Registration: 1/2 1979 CCVM, Suite 700, 1629 K Street, N.W., Washington, DC 20006, Attn: Ms. Martez A. Camilleri.

- 13-14 November** Symposium on the Sociology of Science, Morris Fishbein Center for the Study of the History of Science and Medicine, University of Chicago. Contact: Arnold Ravin, Director, Morris Fishbein Center, 1126 East 59th Street, Chicago, IL 60637; (312) 753-4561.
- 1 December** Second Annual Undergraduate Bioethics Conference, Brown University, Providence, RI. Theme: "Health: Whose Responsibility?" Contact: Carol Cusson and John Sopper, Conference Co-Chairpersons, Brown Bioethics Association, Box 1930, Brown University, Providence, RI 02912; (401) 863-6488 or (401) 863-6008.
- 12-14 December** Conference on Innovation and Continuity in Science, Free University, Amsterdam, The Netherlands. Contact: Conference on Innovation, Vakgroep G.M.A.N., Vrije Universiteit, Postbus 7161, 1007 MC Amsterdam, The Netherlands.
- 27-30 December** Society for the Study of Professional Ethics, with The Society for Business Ethics. Special jointly-sponsored sessions at American Philosophical Association, Eastern Division, Annual Meeting, Americana Hotel, New York City. Contact: Professor Sheri Smith (Society for the Study of Professional Ethics), Rhode Island College, Providence, RI 02808; or Dr. W. Michael Hoffman, Director, Center for Business Ethics, Bentley College, Waltham, MA 02154.
- 28 December** Fortieth Meeting of the Division of Literature and Science, Modern Language Association, in conjunction with MLA Meeting (27-29 December), St. Francis Hotel, San Francisco, CA. Contact: Professor Lance E. Schachterle, Worcester Polytechnic Institute, Worcester, MA 01609.
- 28-30 December** History of Science Society Annual Meeting (in conjunction with the American Historical Association Annual Meeting), New York City. Program Committee Chairman: Arthur Donovan, Department of History, West Virginia University, Morgantown, WV 26506.
- 1980**
- 3-8 January** 146th Annual Meeting, American Association for the Advancement of Science, San Francisco Hilton, San Francisco, CA. Meeting theme: "Science: Our Common Heritage." Preliminary Program and registration information appeared in *Science* (21 September 1979); preconvention issue of *Science* (16 November 1979) will contain complete program.
- 21-24 January** Annual Meeting, American Physical Society, Chicago, IL.
- 2-6 March** Eleventh Annual Conference of the Environmental Design Research Association, The College of Charleston, Charleston, SC. Contact: Stephanie Sanders, The Center for Metropolitan Affairs and Public Policy, The College of Charleston, Charleston, SC 29401; (803) 792-5737.
- 6-8 March** Twenty-third Annual Missouri Valley History Conference (traditional MVHC conference areas, including teaching methodology and interdisciplinary studies), Omaha, NB. Contact: Oliver B. Pollak, Department of History, University of Nebraska at Omaha, Omaha, NB 68182.
- 27-29 March** First Annual Meeting, American Association for the Advancement of the Humanities, Washington, DC.

1980 Meetings (continued)

- 27-29 March** American Philosophical Association Pacific Meeting, Golden Gateway Holiday Inn, San Francisco, CA. Contact: Philip Frandozzi, University of Montana at Missoula, Missoula, MT 59801.
- 28-30 March** Conference on Philosophy, Children, and the Family, Michigan State University, East Lansing, MI. Contact: Albert C. Cafagna or Richard T. Peterson, Department of Philosophy, Michigan State University, East Lansing, MI 48824.
- 17-19 April** "Asclepius at Syracuse: Thomas Szasz, Libertarian Humanist." Alumni House, SUNY-Albany. Contact: Prof. M.E. Grenander, The Institute for Humanistic Studies, SUNY-Albany, Albany, NY 12222.
- 18-19 April** Fourteenth Conference on Value Inquiry. Theme: "Values in the Law." Contact: Director, Fourteenth Conference on Value Inquiry, Philosophy Department, SUNY College at Geneseo, Geneseo, NY 14454.
- 18-19 April** Seventh Annual Meeting, Joint Atlantic Seminar in the History of the Physical Sciences, University of Maryland, College Park, MD. Theme: "Interactions of the History and Philosophy of Science." For information, send self-addressed, stamped envelope to: Professor Stephen G. Brush, History Department, University of Maryland, College Park, MD 20742.
- 24-26 April** Western Division Meeting of the American Philosophical Society (APS), and Spring Meeting of the Society for the Study of Professional Ethics (SSPE), Detroit, MI. APS Contact: Professor Ed Byrne, Department of Philosophy, Indiana University, Indianapolis, IN 46202. SSPE Contact: Professor Sheri Smith, Department of Philosophy, Rhode Island College, Providence, RI 02908.
- 2-3 May** Second Annual Conference in Applied Philosophy, Bowling Green State University, Bowling Green, OH. Topic: "Action and Responsibility." Address inquiries to: Professor Michael Brudie, Conference in Applied Philosophy, Department of Philosophy, Bowling Green State University, Bowling Green, OH 43403.
- 20-25 August** Thirtieth Pugwash Conference, The Netherlands.
- 22-26 September** Third International Congress on the History of Oceanography, Woods Hole, MA. Chairman: Daniel Merriman, Professor Emeritus of Biology (Yale University), 298 Sperry Road, Bethany, CT 06525.



Law and Science: A Selected Bibliography

Compiled by Morris L. Cohen,
Jan Stepan, and Naomi Ronen
(Harvard University Law School Library)

Law and Science is a selected and classified bibliography of the burgeoning literature on the interface of science and technology and the legal system. Books, periodical articles, monographs, and government documents from a wide range of fields--the sciences, law, political science, sociology, philosophy--demonstrate the multidisciplinary nature of issues such as privacy, public health or resource management. Special sections list serial bibliographies, periodicals, or loose-leaf services.

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